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By A. V. HENDRICKSON,
Chemist to the South Suburban Gas Company; Fellow of the Chemical Society
Associate Member of the Institution of Gas Engineers.

This volume represents an endeavour to review the literature, published during the past year, that is of interest to those engaged in gas-works laboratories. A feature of the work is a bibliography, which facilitates reference to the literature summarized in the book.

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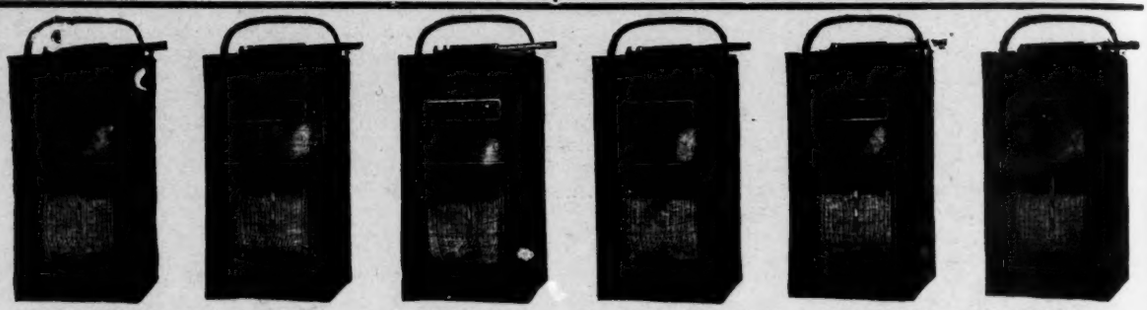

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EDITORIAL NOTES.

First Officers of the National Gas Council.

As said in these columns on a former occasion, it is the duty and the responsibility of everyone in the gas industry to do his part to make the National Gas Council, in every sense of the word, a success. Those who are devoting thought and work to the new body are hoping to merit the encouragement and confidence of the whole of the gas industry; and naturally they cannot anticipate being a complete success unless they do obtain that encouragement. The question of the support of the National Council must not be regarded, in any quarter of the industry, in a narrow spirit. When it is admitted that hitherto there has not been a body that has been representative of the entire interests of the industry, then there is tacit acknowledgment that any new organization—although some of us may see defects in its organic structure—that can work, speak, and act in a fully representative capacity, for the protection and good of the industry, is something to be welcomed, helped, and in every way encouraged. We do not wish the attitude of the "JOURNAL" to be mistaken in this matter, and do not think that it is by the bulk of our readers. The new National Gas Council has been welcomed by us, and a pledge given to assist it in every way. The defect that we see in what may be termed the "hub of the wheel" is entirely a debatable question of policy in regard to the one point of construction. But it may not necessarily have any bad effect either on the running powers or the production of advantageous results for the industry. It is solely a matter of justice. It is conceivable that, having coequal representation upon the National Council and the General Consultative Committee, just as profitable work will in the total be accomplished as if the Society of British Gas Industries had—as in our opinion they ought to have—their equal share in the composition of the Executive Committee. Even so, the Executive Committee does not, through the exclusion of the Society, represent the entire gas industry, of which the members of the Society are an indispensable part. At the same time, it is contended by other members of the National Council that the interests of the Society are well guarded by the provision that, where any question arises relating to their interests, they shall be co-opted; and, as a matter of fact, four members of the Society have been co-opted on the first Committee appointed for the purpose of drafting the constitution and rules. The fear that the power of co-opted members of the Society or any other useful individuals (as occasion may suggest) will remain unexercised is asserted to be wholly groundless. Nevertheless, the difference does remain.

However, we were able to announce in last Tuesday's issue of the "JOURNAL" that the General Consultative Committee of the National Gas Council had held a meeting the previous afternoon for the purpose of making a beginning with the task of getting the machinery into working order, and of formulating a programme. This fact, following so speedily upon the ratification of the resolutions that had brought the Council into being, is conclusive proof that those who have been active in this matter are not disposed to allow the grass to grow under their feet, and fully intend that the Council shall, if at all possible, by deeds justify all that its constitution and title profess it to be. There is now a great opportunity for effective work. The future of the industry depends largely upon its present handling. Therefore we are glad to see that the first work of the Consultative Committee has been to place in official position men holding considerable interest in the industry, and men of much influence, who will be helpful in shaping policy, and in gaining the ears of governmental authorities. Useful men are for the first time placed in prominent office which will give them opportunity and recognition, and will invite and stimulate their interest in the general work of the industry—benefits which have previously been denied the industry through an exclusiveness that has excommunicated talent, and has been destructive of good through the pre-existing premier organization being unable unassisted to accomplish it. Some of the officers will be subject to yearly change or re-election. Means, however, will no doubt be found for providing that those who are valuable to the work of the Council, and therefore to the industry, are kept in close touch with it. It will also be observed that the elections to official positions have been made irrespective of whether the bearers of office are company, municipal, or manufacturing and trading representatives, which is as things should be in an organization the sole interest of which is the common good.

For the first year, the place of honour—the presidency of the Council—has been bestowed on Mr. H. E. Jones. It is as true in the ordinary affairs of life as in higher affairs that "by their works" men are known. Mr. Jones has given long years of service to the gas industry, and stands to-day as great a progressive in gas affairs as he has ever been. The low capitalized, low gas-priced, collier and motor lorry owning, modern equipped, Wandsworth, Wimbledon, and Epsom Gas Company certifies (as does other successful work) the spirited engineering and administrative character of the Chairman in a more cogent manner than any words can do. The Company was one of the first, too, to adopt the calorific power standard. As a Vice-President of the Institution of Civil Engineers, and, it is hoped, a prospective President, Mr. Jones is now representative-in-chief of gas engineering in the foremost professional organization of the country. There are four Vice-Presidents of the National Gas Council; and they are the Presidents of the industry's four chief organizations, which have now been brought together under the one capital, without resigning in any way their individuality and independence. There is Mr. A. E. Broadberry, President of the Institution of Gas Engineers, Sir Hallewell Rogers, President of the British Commercial Gas Association, Sir J. Fortescue Flannery, Bart., M.P., President of the Gas Companies' Protection Association, and the President of the Society of British Gas Industries. Coming next to the Consultative Committee, the Chairman is Alderman F. S. Phillips, J.P., who has been very active in bringing about the formation of the Council, and has proved himself a staunch champion of the interests of the industry. The Vice-Chairman is to be the Chairman for the time being of the Executive Committee; and, in the first instance, this is to be Mr. D. Milne Watson, the Managing-Director of the Gas Light and Coke Company. There is also to be a Deputy-Chairman (what the exact difference is between a "vice" and a "deputy" chairman need not be discussed in these times of pressure); and this position is being filled by Mr. H. M. Thornton, the Chairman of the Council of the Society of British Gas Industries, the members of which will greatly appreciate the election. In other work for the industry—especially as Chairman of the Sulphate of Ammonia Association—Mr. Milne Watson has gained universal confidence for the assiduity he has displayed in keeping pace and dealing with every development that has arisen; and therefore there may be certainty that he will not as Chairman of the Executive Committee of the National Gas Council, allow the work to drift through ennui into a lean productiveness and usefulness. Alderman W. Kay, of Manchester, is unquestionably a marked man for higher office; meantime he fills the roll of Honorary Treasurer. The Honorary Auditors are Messrs. E. L. Burton, F.S.A.A. (Brighton and Hove and other Gas Companies), and Mr. Charles Clare (Society of British Gas Industries). The Joint Honorary Secretaries are Messrs. W. E. Price and F. W. Goodenough.

There is a good deal of energy comprised in this "team" of office-bearers; and there is not, we feel sure, one of the components who will not deem it an honour to be in official

position upon the Council in the days of its inauguration. Such days are critical ones for a responsible body of this kind; for very much depends upon organization and the methods applied at the start. Until the scheme develops, and the character and quantity of work that has to be done can be approximately gauged, there will have to be some—it may be hoped only temporary—reliance upon the staffs of the Institution of Gas Engineers and the British Commercial Gas Association. But we do hope when work is well in hand that the offices of these bodies and of the National Gas Council will be removed into a prominence and suitability better according with the work and status of a large and flourishing industry, and not be left hidden away as now, as though poverty ruled and there was something of which to be ashamed. Such a removal might be the first step to something still more imposing and valuable. The drafting of the detailed constitution and rules for the Council is (as already indicated) now being taken in hand; and then there will have to be, from the questions presenting themselves for consideration, a choice of those that, through exigency or position in importance, should be taken up in the first instance. We hope—it will be the hope of all in the industry—that a large measure of success will soon attend the efforts of the new Council.

Gas Workers' War Bonus.

It will have been seen through the daily papers that trouble has been threatened in the gas industry, over the question of an increased war bonus. In the case of the Gas Light and Coke Company's men, our ordinary channels of intelligence satisfy us that the threat of trouble, if there was not further concession, did not emanate from the men generally, but only from a section; and this is not surprising when the rates of pay and the many special privileges that the men enjoy are considered. However, at the meeting of the Board on Friday last, the Directors resolved, in view of the higher prices now prevailing for food—especially in London—to increase the weekly bonus from 7s. to 10s. The application by the men is undoubtedly traceable to the fact that the Government conceded an addition to the bonus to the railway men—raising it from 5s. to 10s.; and industries generally will have to suffer from the concession, however unjustifiable applications may be for additional bonus in the case of many men who are already being handsomely paid. Employees ought not to assume that the railway 10s. war bonus is a fair standard for all classes of employment. Some of the railway employees have been very poorly paid in the past; on the other hand, many gas workers, apart from the war bonus, are extremely well paid, and ought not to expect the same consideration in war bonus as men in more straitened circumstances, through their work not commanding the same high rate of pay. If there is any fundamental principle applying to the distribution of a war bonus, it surely is that those who are the least capable of keeping body and soul together, through the severity of the war burdens in respect of food prices, ought to receive the larger consideration, and the others less or none at all, according to wages paid. But among some bodies of men, there is no idea of justice, and the stronger hold the view that they should, in the matter of bonus, be paid equally as well as the weaker. Gas undertakings were among those that early and voluntarily gave their men a war bonus on account of the increased cost of living; and gas-works' employees ought to remember this as well as the many benefits they receive through their employment, which are not to be found or experienced universally in other industries. Reasonableness and not greed—particularly does this apply to the best paid ones—should be the attitude of the men in these times when their employers are also suffering heavily from the deplorable circumstances created by the war.

Economy and Efficiency in the Electrical and Gas Industries.

In these days, economical production and distribution, and efficient appliances, form the backbone of commercial and competitive competence in trading. The electricity supply industry is watchful, in its own interests and protection, as to what the gas industry is doing in the way of development in these directions; and it is the duty of the gas industry, in its own interests and protection, to return the compliment. The electrical industry is working assiduously in the direction of cheaper production. Its technical men have now for some time been discussing schemes to that end; and they have got to a point at which some economizing plans are actually in operation, while others are on the *tapis*. Part of the discussion has been more or less of an abstract character; and some of the schemes—such as those contemplating larger concentration of generating plants and the gasification of coal on the large scale, with recovery of bye-products—can only possibly be materialized in the distant future, unless there be earlier co-operation between the electrical and the gas industries, whereby the latter would provide a power or boiler-heating gas supply by the gasification of coke in producers, with ammonia recovery. The line of least resistance for the electricity industry is, in the first instance—development in other directions may more conveniently follow—to make the best possible use of its existing plants, by doing whatever is possible to increase their efficiency. One means is by interlinking the systems. This seems a simple enough thing, and *primâ facie* does not suggest very much scope for producing economy through more efficient working. But experience shows that this is just what is possible.

Only think. There are plants that through the character of the demand are not put to the best use; and the plant load factor is poor. There are plants that, in some parts of the day, are to a considerable extent standing idle. There are plants the fuel consumption of which is very high compared with others. With good boiler equipment and steam-turbines, there are plants to-day generating current with an average consumption per unit of $2\frac{1}{2}$ to $2\frac{3}{4}$ lbs. of coal, while others run up to 5, 6, 7, and more pounds per unit. With the interlinking of a group of undertakings, what happens? The supply from the same aggregate of plant, on the same capital expenditure, can be very largely augmented, and the plant load factor generally improved. The more efficient plant can be put to greater use, and the less efficient plant need only be run at times of peak demand, which would represent a substantial saving in fuel, and to a smaller degree in wages, repairs, and other items of outlay. Interlinking, too, enables the closing-down of some of the stations at week-ends and at times of light load, and for repairs; the amount of stand-by plant is reduced; and the risk of interruptions of supply from any cause is minimized. These are significant advantages, although they cannot well be expressed in money, excepting in regard to fuel. The subject is this week dealt with in our "Electricity Supply Memoranda;" and there are two instances mentioned there of actual fuel savings derived from the interlinking of, in each case, only two electrical supply systems. In one of the examples, the coal saving at both stations has been 2000 tons; and it is expected that it will be increased to 3000 tons. In the other instance, a station of small maximum load was linked-up to one of larger maximum load; and the coal consumption of the smaller station was in consequence reduced by $2\frac{1}{4}$ lbs. per unit—the combined saving of coal by the interchange of current in the second year of working amounting to 5500 tons. This is real economy. It will also be seen from the "Memoranda" that an extensive scheme has been projected, by a Committee of Electrical Engineers, for linking-up into four groups 26 of the principal electrical stations of Lancashire and Cheshire; and it is computed that, without all the other advantages, an average saving of 0·5 lb. per unit on the present average coal expenditure of 3·24 lbs. will be effected by the scheme, if the local authorities will agree, and the Board of Trade, the Local Government Board, and the Treasury will consent. This would bring the consumption down to the excellent average figure of 2·74 lbs.; and the saving, assuming coal to cost 17s. 6d. per ton, would represent no less a sum than £82,000 a year. This would leave a good many thousands of pounds to the good after providing for interest, sinking fund, and depreciation on the work entailed in interlinking, the estimated cost of which is £281,397. This is a cost which cannot but be regarded as a sound investment both from the fuel-saving point of view as well as from that of collateral advantages; for it must be presumed that the dozen prominent electrical engineers who have had this matter in hand have individually satisfied themselves in regard to the solidity of the ground upon which their estimates are based.

The economy and efficiency that it is calculated will be derived—and, as mentioned, actual experience proves the capacity promoting these ends to be inherent in the interlinking process—will be something to the credit of the electric undertakings engaging in joint enterprise of the kind;

and naturally it is prudent for gas men not to overlook any economic development of their chief competitor. There may be assurance that these schemes will not stop at the paper stage. But what is the gas industry doing on its part in the way of deliberately searching for economies, drafting schemes, and endeavouring to give them practical effect? Speaking truthfully, we fail to see anything definite. The National Gas Council, however, is now in existence; and no doubt at the moment zealous deliberation is proceeding in the attempt to devise working procedure. Hopefully, we look to a good result. But the National Gas Council should find a lesson in the healthy work of the Committee of Lancashire and Cheshire electrical engineers. Special committees constituted of active members (we have had sufficient experience of the passive variety) are required to consider definite lines of work aiming at economy for the gas industry. There is not the same need for "interlinking" in the gas industry as in the electrical industry. Gas undertakings have a good diversity of demand; and they have the gasholders with which to balance and eliminate the vagaries of demand. But is there not a great deal that could be done, by co-operation, towards the promotion of economy? Co-operation in the working-up of residuals at a central plant; co-operation in the owning and working of steam colliers; co-operation in the proprietorship and running of railway waggons; co-operation in other ways that other brains may suggest. There is also the question to be considered as to whether the gas industry cannot become suppliers of power gas in industrial areas, which would lead on to the subject of whether the gasification of coke and ammonia recovery from it are not among the economic developments. There is much work to be done as to carbonization temperatures in relation to the production of tar oils, and in regard to the relationship of such temperatures to residual values generally. Sulphate of ammonia is a consideration of no mean importance in respect of the future; and it is clear that the larger the production of this fertilizer per ton of coal carbonized (even by the aid of recovery through the gasification of coke for power purposes), the more strength coal carbonizers will possess against synthetic ammonia in the commercial arena. The assistance and protection of economy and efficiency have to be searched for in every direction. The electrical industry is alive to this, and is at work. The gas industry must not be behind in the securing of all possible advantages; for there most certainly is stern conflict ahead.

Enlarging the Functions of the Ascension.

THERE is no particular interest to-day in any disputes as to personal credit or rights to the idea of a common ascension-pipe for a number of gas retorts. The notion is an old one; so that no one now could well claim novelty in it. British and American inventors many years ago fancied they saw benefits in it; and since others have also been enamoured of it, some suggesting the connection of horizontal rows of retorts to a common ascension or "stand-pipe," and others preferring take-offs from vertical rows of retorts—a method which seems to be the most natural one. Others again have planned delivery into one large ascension from two vertical rows of retorts; but the single vertical row to one ascension appears to be preferred. Until recently there has not been any real experience with single ascensions common to a row of retorts—whether a horizontal or vertical row. But all the proposals have lain dormant. At the same time, the suggested advantages of the single ascension are important. There is the lessening of the surface equipment of the retort-settings—thus saving expense. The possibility is put forward of a greater concentration of the retorts—thus saving space in relation to carbonizing capacity. Stoppages of ascensions are, we are told, to be experiences of the past. Greater liberty in the shutting-off for repairs or cleaning of individual retorts is obviously provided by the introduction of a valve on each take-off leading into the common ascension, and that valve as accessible as the retort-lid.

These are among the claims for the old idea, which has only been favoured by comparatively modern adoption in America. But, as seen by communications that have lately appeared in our columns—there is one this week—from Mr. R. C. Congdon, of the Atlanta (Georgia) Gas Company, he has carried the idea somewhat farther than his predecessors, by extending the functions of the single ascension-pipe so as to prove of advantage not only in the prevention of "the "accumulation of tar, pitch, and lamp-black inside the "stand-pipe," but to other sections of the plant by relieving them of some part of their duties. In other words, by circulating water, water-gas tar, or other fluid inside the ascension-pipe (avoiding any escape into the retorts themselves), the gas is said to be partially scrubbed and cooled, "thus lessening the burden on the balance of the works, "and thus increasing the capacity of the exhausters, con-"densers, and scrubbers." It goes without saying that, if the gas can be appreciably cooled and an additional amount of impurities can be removed from the gas at this early stage, by the assistance of the new invention, there will be less work for the succeeding condensing, scrubbing, and purifying plant to do; which (as well as the immunity from stopped pipes, and the reduced cost of installation) is something every gas engineer would appreciate. Information, however, is wanting as to the exact effects of Mr. Congdon's system of cooling and scrubbing in connection with large ascension-pipes common to a number of retorts. He tells us that not only has the system been installed at Atlanta, but at Philadelphia and Taunton, and is now being introduced at other places. This adoption expresses satisfaction; and we draw from it the impression that at Atlanta, Philadelphia, and Taunton there is in the possession of the engineers the results of good experiences. For the moment, we have enough of description, and should like more of the experience. We should be pleased, for instance, if experiments have been made, to have an analyses of the crude gas, and of the gas upon its exit from the standpipe after treatment; we should like, too, the incoming and outgoing temperatures of the gas. It would be interesting to have, for comparison purposes, the corresponding particulars without the liquid circulating arrangement in use. It would also be instructive to have information as to the experiences in the shape of relief upon the condensing, scrubbing, and purifying plant in consequence of the pre-cooling and pre-scrubbing in the large ascension-pipe. There is much information that ought to make very readable articles, relating to the actual work done in contrast with the ordinary condition of "one retort, one ascension," or with the large stand-pipe without the washing and cooling arrangement in operation. Further particulars of this kind would certainly enlarge interest on this side.

Work for Disabled Soldiers and Sailors.

Is there any way in which the gas industry can follow the good example of the electrical industry in the matter of training for special work disabled soldiers and sailors? The gas industry will naturally take into its employment for suitable work as many as possible of the maimed heroes who return from the front; but is there not something more that can be done? The electrical industry like the gas industry is suffering from a shortage of men. Already, however, some of the disabled warriors have been found duties at power stations and sub-power stations; and, under the auspices of the Institution of Electrical Engineers, others are being trained at the Northampton (London) Polytechnic Institute for employment on district electrical work. At Queen Mary's Convalescent Hospitals at Roehampton, through the beneficence of Lady Wantage, aided by equipment supplied by manufacturers and contractors, workshops have been erected in which disabled men are also (if they fancy electrical work, and some 25 per cent. of the men do) being trained in the art of electric wiring, lamp fixing, the care and management of electric-motors, and other things electrical. A generating set is now desired with oil-engine and dynamo for country house lighting; and, when this is secured, the men will be taught its technicalities and management. From Roehampton, some of the men go on to the Regent Street Polytechnic, where further free tuition is given them. The electricity supply industry is bent on recruiting its forces as early as possible. Is there a hint in this for the gas industry?

Coal Topics.

The Home Department and the Coal Organization Committee are getting somewhat alarmed over the amount of avoidable absenteeism at the coal mines; and the miners are by their action forcing the day of the revocation of the exemption certificates of those who will not render full work. We have already drawn attention to the part of the recently issued report of the Coal Organization Committee in which they stated that, while (up to the period with which their report dealt) there had been an improvement in

avoidable absenteeism, there was still a large margin between the avoidable and unavoidable absenteeism upon which to work. But the "Iron and Coal Trades Review" is inclined to think that just latterly the avoidable absenteeism, instead of improving, has got lamentably worse. This opinion is formed from an investigation in Yorkshire and Derbyshire, which shows the increase is of a character that is somewhat startling. That the Home Office is very much disturbed by the existing state of things is shown by a letter that Sir Richard Redmayne has addressed to the Local Absenteeism Committees. Representations have been made to the Home Office regarding this excessive absenteeism; and Sir Richard says that the Home Secretary "is of opinion that a man who, in spite of the appeal of the Government and remonstrances of his own leaders, refuses or neglects without good cause to render full service to the State, for the purpose of which he has been exempted from military service, cannot continue to be so exempted; and he will be prepared to instruct the Colliery Recruiting Courts to consider the question of the revocation of a certificate of exemption." This means that such men will be called up for military service. One other point refers to the raising of the standard excess price. The Forest of Dean Collieries obtained in September, 1915, an increase of the standard from 4s. to 5s. They recently asked for a further rise of 4s.; but the Board of Trade have granted them an additional 1s. 6d., which makes the amount 6s. 6d.—the same as in South Wales.

Deterioration of Leather in Gas-Meters.

Although greatly in favour of increased effort in research by collective means, we should be very sorry to see any discouragement to individual research. For some years now, the South Metropolitan Gas Company has been augmenting its economy and efficiency by the aid of research on its own account; the view of the Chairman (Mr. Charles Carpenter, D.Sc.) being that this is not only an obligation but an essential to and in the work of such a concern. From these researches, the Company has given the practical results freely to the gas industry. There is now a further addition to the indebtedness of the industry to the Company, through the publication of the results of an investigation into the question of the deterioration of the leather used in gas-meters, which publication is made by Mr. M. C. Lamb (of the Leathersellers' Technical College, Tower Bridge Road), who undertook the research upon the invitation of the Company. Though Mr. Lamb suggests that the conclusions shall not all be taken as final, and gives promise of further inquiry and results, the conclusions at which he has arrived are highly valuable. But, notwithstanding that he has been at work on the subject since 1913, he, like the Joint Committee of the Institution of Gas Engineers and the Society of British Gas Industries, does not supply any definite elucidation of the question as to why meter parts have been showing more rapid deterioration of late years than formerly. The present inquiry is of additional interest because the South Metropolitan Company make straight coal gas and not any carburetted water gas, to which some people ascribe the more rapid deterioration of the leather owing to the high percentage of paraffin hydrocarbons. We cannot imagine, too, that the South Metropolitan Company are short of scrubbing or washing plant, seeing the degree of gas purity to which they successfully aim; so that this again cannot be blamed for the deleterious constituents found in the liquid in the meters.

The Findings.

Dr. Lessing showed, in his report to the Joint Committee, that the acid and ammonium salts in the meter liquid had a deteriorating effect upon the metal parts of the meters; and Mr. Lamb takes us a step further by showing that the corrosive action of the acid and ammonia constituents on the metal band to which the leather is attached is the cause of the deterioration of the leather. In other words, the effect upon leathers left immersed in meter liquids for months showed negative results; but when samples of the leather were brought into contact with metal strips and then left immersed in the liquid, the deterioration of the leather in contact with the metal was most pronounced, and the deterioration spread, but to a diminished extent, to other parts of the leather. Examination of the leather and diaphragms of a considerable number of meters returned for repair from the South Metropolitan Company's district confirmed the findings of the experiments. In all cases, the leather was hard, perished, and discoloured (in the majority of cases practically black) where it had come in contact with the metallic band fastening the leather to the diaphragm, or else with the diaphragm itself. The deterioration is undoubtedly caused by iron, which converted the tannin into a tannate of iron; and this, Mr. Lamb says, by continuous oxidation and reduction, made the leather hard and caused it to disintegrate and perish. The report deals with the methods of attachment of the diaphragms, and condemns some of the adhesives used by meter makers. It discusses the suitability and unsuitability of oils used in dressing the leathers. Light is also thrown upon changes effected by the South Metropolitan Company as the result of the experiments, which changes have been found highly beneficial. They have substituted an aluminium band for the steel band attachment, have discontinued the use of an embedding agent and have adopted a semi-chrome leather—the specification for which is included in the article printed on other pages. Experience following these changes has been good; and this is proof of a step having been taken in the right direction. It is a question of reducing the acid and the ammonia constituents in the meter liquid which affect the steel bands, or employing materials and methods in the construction of meters which will withstand the attacks of the constituents of the liquid. The Company are taking the latter course. Mr. Lamb, towards the end of his article, criticizes certain of the deductions of Dr. Lessing.

Coal and Coke Exports.

The Board of Trade returns for September continue the tale of the firm control that the Coal Exports Committee are keeping over the quantity of coal that is allowed to leave our shores. The amount for the month was 3,444,180 tons, which compares with 6,197,180 tons in the pre-war September, 1913; so that the reduction was 2,753,000 tons. In the first war September (1914), the exports amounted to 3,859,188 tons; so that the coal export of last month showed a diminution on that month of 415,008 tons. In September, 1915, the export was 3,892,033 tons; so that last month's shipments were 447,853 tons less than that month. The total values of the quantities mentioned were: 1913, £4,282,167 (6,197,180 tons); 1914, £2,514,581 (3,859,188 tons); 1915, £3,448,684 (3,892,033 tons); 1916, £4,452,643 (3,444,180 tons). The coke exported in September, 1913, was 125,357 tons (value £113,660); in September. 1914, 130,264 tons (value £94,340); in September, 1915, 108,471 tons (value £140,807); in September, 1916, 129,799 tons (value £227,877).

OBITUARY.

The death occurred last Friday week of Mr. Walter E. Case, the Chairman of the Frome Gas Company. Deceased, who was about fifty years of age, died quite suddenly. He was the head of a well-known tannery business at Frome and Westbury.

PERSONAL.

Much sympathy will be felt with Mr. William Griffin, the Secretary and General Manager of the Folkestone Gas and Coke Company, who has received news that his only son, Clive (the bestowal on whom of the Military Cross was notified in the "Journal" last January), has been very severely wounded while serving with His Majesty's forces.

Mr. Harold Singleton, the Manager of the Huddersfield Corporation Gas-Works, was married last Tuesday, at St. John's Church, Golcar, to Miss Amy Pearson, youngest daughter of Mrs. Pearson and the late Mr. Albert Pearson, of Golcar. The wedding presents included a barometer from the staff and a silver fruit basket from the foremen at the gas-works.

Among the recipients of the Order of the French Legion of Honour is M. Pierre Bro, the Engineer to the Oran Gas-Works. M. Bro was a lieutenant in an artillery division in Africa, and was mortally wounded by a shell. The same distinction has just been awarded to M. Désagneaux, Director of the Esbly Gas-Works, Seine-et-Marne, whose bravery and efficiency as an artillery officer are highly spoken of by General Galliéni.

On the occasion of his marriage, Mr. Walter Parker, the Superintendent of the Lum Street Gas-Works of the Bolton Corporation, was presented by the officials and workmen with a handsome timepiece suitably inscribed; his wife at the same time being given a piece of silver plate. The Gas Engineer (Mr. W. J. Smith, B.Sc.), who took the chair, spoke of the valuable services rendered by Mr. Parker to the Bolton Corporation and to himself during his seven years' service with the department. Mr. Robert Cornett, in making the presentation, referred to the kindly feeling existing between Mr. Parker and the men.

NATIONAL GAS COUNCIL.

Election of Office-Bearers.

THE First Meeting of the General Consultative Committee of the National Gas Council was held at St. Ermin's Hotel, on Monday last week.

The following officers were elected for one year :

President of the Council.—Mr. H. E. JONES, M.Inst.C.E.

Vice-Presidents.—

President of the Institution of Gas Engineers, Mr. A. E. BROADBERRY, M.Inst.C.E.

President of the British Commercial Gas Association, Sir HALLEWELL ROGERS, J.P.

President of the Gas Companies' Protection Association, Sir J. FORTESCUE-FLANNERY, Bart., M.P.

President of the Society of British Gas Industries.

Chairman of the General Consultative Committee.—Alderman F. S. PHILLIPS, J.P.

Vice-Chairman.—The CHAIRMAN OF THE EXECUTIVE COMMITTEE.

Deputy-Chairman.—Mr. H. M. THORNTON.

Chairman of Executive Committee.—Mr. D. MILNE WATSON.

Hon. Treasurer.—Alderman W. KAY, J.P.

Hon. Auditors.—Messrs. E. L. BURTON and CHARLES CLARE.

Hon. Secretaries.—Messrs. W. E. PRICE and F. W. GOODENOUGH.

The offices *pro tem.* of the Council will be those of the Institution of Gas Engineers, No. 39, Victoria Street, S.W.

The drafting of the detailed constitution and rules was referred to a Committee.

NEW MEMBER OF THE CONSULTATIVE COMMITTEE.

In last week's issue, the names of the members of the General Consultative Committee were published; but there was one member short in the list of the Gas Companies' Protection Association, owing to Mr. Thomas Waddom (who was among the nominees of that body) having been appointed one of the representatives of the British Commercial Gas Association. We are now informed by Mr. F. E. Cooper, the Secretary of the former Association, that their representation has been completed by the acceptance of the position by Mr. Hanbury Thomas, of Sheffield.

CALORIFIC STANDARD ACT APPLICATIONS.

Seventh Official List.

THE Board of Trade intimate the receipt of applications from the following Gas Companies for Orders under the Gas (Standard of Calorific Power) Act, 1916; the standard proposed in both cases being 500 B.Th.U.

BOURNEMOUTH GAS AND WATER COMPANY.
HAMPTON COURT GAS COMPANY.

National Insurance (Unemployment) Acts, 1911 to 1916.—The Umpire has decided that contributions are payable in respect of workmen engaged wholly or mainly in the manufacture (including generating and compressing) of acetylene gas; the manufacture of cylinders for holding the gas, and examining cylinders and filling them with porous material.

Coal for France and Italy.—The Board of Trade announce that arrangements have now been completed by the various interests concerned for regulating the supply of coal from the United Kingdom to French and Italian ports in the Mediterranean; and the new scheme will come into operation on the 30th inst. The scheme follows the lines of the existing arrangement for the supply of coal to the Channel and Atlantic ports of France, which has been working since June 1, and provides a maximum scale of freights, a maximum scale of coal prices, and a tariff for the services rendered by the coal exporters. The new scheme applies to Mediterranean ports.

Patent Ferro-Stone Glazing.—Patent ferro-stone glazing has become so popular in buildings such as factories, warehouses, and other structures requiring either vertical or roof-glazing, that the Company supplying it has altered its title so as to associate with it its speciality. The title of the Company is now the Ferro-Stone Glazing Company, Limited; its Managing-Director is Mr. Alfred E. Drown, Assoc.M.Inst.C.E.; and the offices are at No. 20, Victoria Street, S.W. The Company are glazing with their patent ferro-stone bars the roofs of the new engine, boiler, pump, and washer houses for the Tottenham District Light, Heat, and Power Company. In the making of the ferro-stone bars, improved machinery and methods have been adopted; and bars up to 18 feet long can now be made, delivered, and erected with the utmost dispatch. The bars can be fixed to wood or steel. They are weather-proof, damp-proof, fire-proof, require no painting, and a good consideration (so our information runs) is that they are cheaper than any other glazing bars.

ELECTRICITY SUPPLY MEMORANDA.

THE electricity industry is excited. There has been, within the past fortnight, a perfect avalanche of reports and other material on the question of effecting economy in the generation of electricity, and in ensuring the continuity of supply, which latter is one of the greatest troubles with which the industry has to contend. The industry has been going on year after year piling-up uneconomy and indiscretion in the development of its undertakings; and to this it has suddenly awakened, has admitted, and now wants to atone by the application of whatever remedial measures are available. It is, of course, the right thing to take advantage of every means of bringing economy to the credit of the working account; and every economy that is effected in generating costs means the placing of the electrical industry in a stronger position as a competitor. This is a point that the gas industry must keep before it in the effort to produce additional economies of its own. Here in existence are electricity undertakings of all capacities and of varied efficiencies. They cannot be scrapped, and the whole be reconstructed to one standard of productive efficiency. Therefore, the question arises as to how the undertakings can be mutually helpful in the way of utilizing the aggregate of plant in the best possible manner. The answer is found in interlinking. Some of the Metropolitan undertakings have interlinked; and now the first of large schemes are in outline for industrial Lancashire and Cheshire. The advantages of interlinking are: From the plant of existing stations the supply could be greatly increased; the risk to interruption of supply would be materially diminished; by making the fullest use of the efficient plant on each system, and only running the less efficient plant at times of heavy demand, a considerable saving could be effected in fuel, and to a lesser degree in wages, repairs, and other items of expenditure; a number of the generating-stations in each district could be shut-down at week-ends, at times of light load, and for repairs; the amount of stand-by plant could be reduced, which would greatly conduce to economy of capital expenditure in future. These are very material considerations. And during this time of restricted capital expenditure, and high-priced fuel, such a scheme, which would enable plant to be run at the highest possible efficiency, would undoubtedly be very valuable.

Working for More Economical Production.

Interlinking Action and Savings.

The Board of Trade some little time ago suggested interlinking of electricity concerns in order to effect economy in the use of fuel. This had been talked about before; and the Institution of Electrical Engineers had discussed the subject. The Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies appointed a Joint Committee; and a Committee was also formed to deal specially with Lancashire and Cheshire, of which Committee Mr. S. L. Pearce, the Electrical Engineer of Manchester, is Chairman. From both this Lancashire-Cheshire Committee and the Joint Committee important reports have emanated. The greatest interest centres in that from the Lancashire-Cheshire Committee, inasmuch as concrete schemes are adumbrated in it. By this Committee, the undertakings in the two counties were divided into six groups, which were reduced to four, by sifting-out those concerns which could not, owing to location or other causes, be economically dealt with; and these four groups comprise 26 undertakings. This Committee, composed of competent engineers, find that the average consumption of fuel per unit generated of these concerns is 3·24 lbs.; and that this can be reduced, under their group system of interlinking, by an average of 0·5 lb. per unit. With coal at 17s. 6d. per ton, this fuel economy would represent a saving of no less than £82,000 per annum. This is a substantial sum, and represents a considerable advantage in the commercial and financial position. And, of course, 17s. 6d. per ton is a low figure as coal prices for steam-raising run to-day. So that, when the cost per ton is higher, the saving would be proportionately greater. The Committee have not only been active in plotting-out their schemes, but they are energetically taking the preliminary steps to give effect to their recommendations. They have interviewed the Board of Trade, with a Treasury representative in attendance, and pointed to the influence in the national economy that such schemes would have. The Board and the Treasury seem to have caught some of the enthusiasm of the Committee, and have given the scheme their blessing. The Treasury have promised to favourably consider the expenditure of the necessary money, provided the Local Government Board and the Board of Trade are satisfied with the more detailed proposals to be hereafter submitted to them, and the Treasury themselves are satisfied that there are substantial economies to be realized in both money and labour. The twelve electrical engineers on the Committee are persuaded that there are real large economies in their proposals; and so their combined ability ought to easily bring the belief of the Government Departments in line with their own. The next step in the progressive movement is the convening of a general conference of the statutory supply authorities concerned, with (it is hoped) a Government official presiding. Following on, the Board will—if there is no impediment to the fulfilment of hopes thus far—be asked to set up a General Com-

mittee or Board with power to enable agreements to be entered into with power companies whose participation is regarded as being essential.

Interlinking Costs—Coal Consumption.

The Committee's estimate of the cost of this large interlinking scheme is £281,397. Group "A" consists of Manchester, Middleton, Salford, Stretford, Stockport, and Trafford Power and Light Supply, Limited; and the estimated cost of interconnecting the systems is £58,839. Group "B" comprises Bolton, Bury, Heywood, Lancashire Electric Power Company, Leigh, Radcliffe, Rochdale, South Lancashire Tramways, and Wigan; and the calculated cost of interconnecting the systems is £31,375. Group "C" consists of Ashton, Glossop, Oldham, and Stalybridge Joint Board; and the cost of interconnecting these systems is put at £23,900. The computed cost of interconnecting Group "A" with Groups "B" and "C" is £83,783. Group "D" is composed of Accrington, Blackburn, Burnley, Colne, Darwen, Nelson, and Rawtenstall; and the estimate of the cost of interconnecting these systems is £83,500. It has been pointed out that the average coal consumption per unit generated by these various undertakings is 3·24 lbs.; but this average figure does not tell the whole tale. Frequently during the fuel economy campaign, attention has been directed to the considerable difference there is in the fuel consumption of electricity generating stations; the heavy figures being no doubt due to plant that is not up to modern standard in efficiency more than to want of skill in management. In the case of the undertakings comprising Group "A," the consumption of coal varies from 2·79 lbs. to 5·62 lbs. per unit; in Group "B," from 2·48 lbs. to 7·97 lbs. per unit; in Group "C," from 2·79 lbs. to 6·01 lbs.; and in Group "D," from 3·12 lbs. to 6·31 lbs. These figures show there is good scope for improvement; and it is the considered judgment of the Committee (as already mentioned) that the average of 3·24 lbs. can be reduced by 0·5 lb.

Actual Results in Coal Saving.

Leaving the report of the Lancashire-Cheshire Committee, and turning to that of the Joint Committee of the Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies, its most interesting feature is found in information given as to the actual results of interlinking. The first is the case of two power stations, each carrying about 7000 KW. of load, which were linked-up at a cost of £3000; the link having a capacity of 3000 to 4000 KW. The advantages shown were: By shutting down one station each night (12 midnight to 6 a.m.) and week-ends (from noon Saturday to 6 a.m. Monday), (1) the plant load factor at each station has been increased from 67 to 72 per cent. (2) The total saving of coal per annum in both stations has been 2000 tons; and it is anticipated that this saving will be increased to 3000 tons. The second is the case of a power station having a maximum load of 2000 KW., which was linked-up with another power station having a maximum load of 15,000 KW. During the second year of working "linked-up," the coal consumption of the smaller station was reduced by 2¼ lbs. of coal per unit on all units generated by the station, and the combined saving of coal due to interchange of current in the second year of working amounted to 5500 tons.

Compulsory Abolition of the Use of Coal in Industry.

The ideals of Mr. R. A. Chattock, the Electrical Engineer of Birmingham, soar far above mere interlinking. He is looking forward to mammoth stations, and to the incorporation in the system of coal carbonization and residuals recovery, with the use of gas and coke under the steam-boilers, or the gasification of the coke to produce more gas and more ammonia. He has expressed himself on this point before; and he has accentuated his views in an address to the Birmingham Association of Mechanical Engineers, which address was noticed in our news columns last week. He is in favour of the compulsory abolition of the use of raw coal for any power purposes. Of course, there is not much good in completely abolishing the use of coal for steam-raising, seeing that there are some grades of coal that are only fit for such purposes as feeding the furnaces of steam-boilers. But no doubt he was speaking generally. The basis of the case he presents is that, in the report of the Royal Commission on Coal Supplies in 1905, the average figure of 5 lbs. of coal per horse-power-hour was given as being the consumption of industrial concerns in connection with the production of their own power. This would be with coal of all grades. However, taking the figure, it could be reduced in modern electric power stations by one-half—giving an economy of 50 per cent. in the manufacturers' coal consumption. This is reckoning on the use of ¾ unit of electrical energy per horse-power-hour. On this ground, Mr. Chattock pleads for making obligatory the discontinuance of the use of raw coal in manufacture. But he does not show that his ideal of large concentrations of generating plant are going to do any better than interlinking, so far as coal consumption goes; seeing that the Lancashire-Cheshire Committee whose report is noticed in the preceding paragraphs show that, taking the electricity stations in those counties, with their good and bad fuel consumptions rolled-up together, the average use of coal per unit of electrical energy is 3·24 lbs., which can be reduced by interconnection to 2·74 lbs. Then he goes on to speak of the coal gasification and residuals recovery schemes, and of the provision of large stations for this purpose and for generating current from the gas; but he sees an enormous capital expenditure in this direction, the handling of considerable additional quantities of coal, and the difficulty of water supplies for cooling purposes—matters to which he has previously drawn attention, on which occasion, too, he expressed his opinion that the gasification of the coal should be left to carbonizing experts and the residuals development to chemical experts, leaving the electrical engineer to develop his own branch of the business. Only in this way would all-round efficiency be secured. There is a point against high concentrations of plant, and that is the danger to the reliability of electricity supply. It was an unkind fate that three days after the address was delivered by Mr. Chattock, the electric tramway service at Birmingham broke down through trouble with the electric generating plant. This is not the first time. Not long before this, too, a bomb from a hostile airship found its sphere of activity in an electricity generating station elsewhere. Not so very long ago, an epidemic of fires at generating stations was experienced. There is something to be said, besides the saving in fuel consumption, for scattered electricity stations and interlinking. However, Mr. Chattock deplores what he calls the slow development of the electric supply business, which he sees will continue, unless compulsion is employed in preventing the use of raw coal for power purposes.

Holmes and Home Hot-Water Supplies.

Some people acquire quite a proficiency in throwing brickbats without supplying any information as to the justification (if any exists) for their action. When invited to supply the justification, and they do not respond, then one is at liberty to draw conclusions without more being said. In the "Memoranda" for Sept. 19, we invited Mr. H. H. Holmes, of Marylebone fame, to supply us with certain information as to statements he had made in print in defamation of heating water by gas. He evidently has not seen these comments; or, if he has seen them, he has probably (perhaps conveniently) forgotten to reply. We are reminded of our invitation to him by the letter that appeared in the "JOURNAL" last week from the Richmond Gas Stove and Meter Company on the subject of the relative costs of heating by gas and electricity, and which letter is not extravagant on the side of gas, and certainly is most amiable to electricity in allowing the electric hot-water apparatus all the advantage of a theoretical 100 per cent. efficiency at the drawing-off point, which, of course, is an impossibility in practice, particularly with a circulating and storage system. On the other hand, the efficiencies taken for gas possess a good margin of safety, which give the firm, if called upon, scope for substantiating what is put forward. Now will Mr. Holmes be prepared to demonstrate to the Richmond Company that they are wrong, and that instead of the moderate efficiencies they take, quite 80 to 90 per cent. of the heat generated by the gas does not appear in the form of heat in the hot water in a bath or other receptacle? It will be observed too, that in the data as to costs, our correspondents calculated on the raising of the water from an initial temperature of 45° Fahr. up to a drawing-off temperature of 150°. But a favourite basis of calculation by electricians is to start at 60° and end at 110°; so that the cost of raising the temperature of the water only 50° is shown. However, the figures in the letter showed that the cost of heating water by electricity (giving it the advantage of a theoretical 100 per cent. efficiency) is three to four times more than in the case of gas—charging gas out at the lighting rate of 2s. 6d. per 1000 cubic feet, while calculating the cost of electricity at 1d. per unit, or only one-third, one-fourth, or one-fifth (as the case may be) of the lighting rate. The figures are worked out to per gallon. Multiplying the difference of cost by the number of gallons of hot water used in a year, and the total difference will be one which would astonish most householders. Installation expense for gas is referred to in the Richmond Company's letter; but they do not say anything about the economy of time in the case of gas, nor the assaults committed by electricity on the patience and convenience of the members of households who venture to use the leisurely electrical heat energy for raising the temperature of water.

Gas Supply Conditions in Cincinnati.—The appointment has been decided upon, by the Federated Improvement Association of Cincinnati (Ohio), of a Committee to ascertain the feasibility of the city buying the present plant of the Union Gas and Electric Company, or of building a new one to manufacture artificial gas. Part of the duty of the Committee will be to find out what it would cost to produce artificial gas at the nearest coal-mine, and pipe it to the city.

Restrictions on Imports.—A revised list of all interpretations and rulings already made with regard to restrictions on the importation of certain goods is published in the current issue of the "Board of Trade Journal." Among the prohibited articles there appear brass gas-burner bye-passes, forced-draught gas-furnaces, "Simplex" gas-lighters, brass parts of gas-meters, ignition-wheels for automatic lighters. Goods allowed to be imported under general licence include iron gas-burner castings. Importation is not prohibited of incandescent gas chimneys, gas-globes, gas-shades, magnesia rings (manufactured of magnesia and potters' clay) for incandescent mantles, magnesium mantle rings.

A HANDBOOK FOR TECHNICAL CHEMISTS.*

THE first part of this book consists of ninety pages of general tables of a kind familar to every analytical chemist. The tables include the usual lists of atomic weights, specific gravities, melting points, boiling points, solubilities, and factors used when making gravimetric analyses. Tables are also given for comparing temperatures indicated by Fahrenheit, Réaumur, and Centrigade thermometers, for converting English to metrical weights and measures, and for reducing gaseous volumes to their volumes under standard pressure and temperature. Table 31 which gives the properties of the liquified gases of commerce, as set forth by Dr. G. Lunge, is interesting; and the conditions of transit for these liquefied gases on German railways are noteworthy. Most of the tables are, however, similar to those to be found in many other chemical handbooks, and do not call for special notice in our columns.

The second portion of the book is entitled "Special Part," and consists of 165 pages, which are mainly devoted to a description of the methods of analysis adopted in acid and alkali factories. Methods suitable for analyzing the materials used or produced in factories which manufacture sulphuric, hydrochloric, or nitric acid, sodium carbonate or hydrate, ammonium sulphate, bleaching powder, chemical fertilizers, or Portland cement, are very briefly described; but no organic compounds, such as coal tar, or tar derivatives, come within the scope of the book. Coal and peat are, however, organic substances which do receive a little attention as fuels.

The methods selected for description have been chosen on the principle that, as a rule, only one method should be given for each analytical operation. In cases where several different methods, equally accurate, are known, preference has been given to the one most extensively employed, or that which requires least time or apparatus. Many new methods are, in consequence, omitted; but it is stated in the preface that in all cases such omissions have been justified by a careful examination of the relative merits of the processes under consideration, and that only such methods as have been found thoroughly reliable have been included. The dimensions of the book have in this way been kept conveniently small; but since opinions differ as to which are the best methods to adopt, it is certain that the selection found in the handbook under review will not meet with universal approval.

The sections of the book which are of greatest interest to those engaged in the gas industry are those which deal with the testing of fuel and furnace gases, the analysis of coal gas, and the examination of gas liquor and spent oxide. The section devoted to sulphuric acid manufacture will be useful in those gas-works in which a sulphuric acid plant has been erected.

The disadvantage of describing only one method of conducting an analysis is particularly noticeable in the case of the section on the analysis of coal gas. The author describes only the method of using Bunte burettes, and says that for a satisfactory analysis of coal gas the Orsat apparatus is not sufficiently accurate. Preference is given to the gas burettes of Bunte, Drehschmidt, Hempel, and Pfeiffer. As a matter of fact, it is probable that the Hornby modification of the Orsat apparatus, when its measuring tube is charged with mercury and provided with a water-jacket, yields results more accurate than those commonly obtained with Bunte burettes. It is certainly quite as useful for the bulk of technical analyses. The ordinary form of Orsat apparatus is described in the section which deals with the analysis of furnace gas. We are unable to find in the book any reference to the Evans apparatus for ascertaining the amount of nitrogen in coal gas. In view of the fact that the proportion of nitrogen in the coal gas produced in many localities has materially increased in recent years, the determination of the quantity of it is now a matter of very considerable importance. It is a pity that the Evans apparatus is not described; for it affords means of making the nitrogen determination much more rapidly than by the usual process of analysis, and it has certainly been in use for a sufficiently lengthy period to prove its practical utility. Furthermore, Dr. Lunge remarks that the calorific power of coal gas is best ascertained by means of the Junkers calorimeter, whereas we well know that it may be ascertained quite as readily and as accurately by the Boys' or the Simmance and Abady calorimeter.

There is a certain degree of danger for those of limited analytical experience in the extreme brevity of the instructions for analyzing some of the compounds mentioned in the book. For example, the processes for the analysis of quicklime given on page 158 might lead an inexperienced operator to overlook the presence of appreciable quantities of impurities, or to report as carbonate of calcium the carbonates of other elements, although experienced chemists may be able to use the processes with advantage as mere control tests.

In spite of its limitations, the book should be placed in the laboratory of every gas undertaking. In addition to its many useful tables, it contains so much information concerning the testing of gases and the inorganic products used or manufactured on a gas-works that it is well worth the half-guinea required for its purchase.

* "The Technical Chemists' Handbook. Tables and Methods of Analysis for Manufacturers of Inorganic Chemical Products." By George Lunge, Ph.D. Second Edition, Revised. London: Gurney and Jackson; 1916. [Price 10s. 6d.]

LOCAL AUTHORITIES AND INCOME-TAX.

THERE has never been a time when the laws relating to income-tax were so much in the public mind as at present—or, it may be added, when it was so necessary to thoroughly understand them. The result has been the publication of a number of enlightening works on general aspects of the subject, which have been welcomed by a puzzled public, anxious to ascertain the true extent of their liability under Finance Acts which succeed one another with the rapidity which one has become accustomed to associate with financial movements in these exceptional times. Now these general treatises are supplemented by a work which—useful as they may have been—will be far more valuable to the officials of municipal finance departments; for it deals particularly with the income-tax laws in their relation to the accounts of local authorities.* The authors [Messrs. F. Ogden Whiteley, F.S.A.A., and William Whittingham] are, of course, excellently well qualified to tackle the difficult task to which they set their hand—that is, the compilation of a simple handbook on a subject upon which they have found there is probably more misunderstanding than upon any other phase of municipal accountancy. Mr. Whiteley, the City Treasurer of Bradford, is very well known in his profession, and Mr. Whittingham is on his staff.

It is easy to understand that, as they themselves declare, it was with some diffidence they undertook the publication of their work, particularly having regard to the exceptional conditions now prevailing. But, at the same time, they felt that the present moment was most opportune to afford the maximum amount of assistance to those interested, inasmuch as "the valuable work of the Executive Council of the Institute of Municipal Treasurers and Accountants, in their negotiations with the Inland Revenue Department, is now almost completed, and has resulted in codifying the rules upon which the assessments of the undertakings of local authorities are to be computed, and the memorandum setting out those rules has just been issued." This assistance, then, they offer; and that it will be eagerly accepted by local authorities, and their officers, throughout the country there is no reason whatever to doubt.

After dealing generally with the principles upon which income-tax is levied, there is a retrospective survey, in the course of which attention is devoted to the contention of local authorities that they should be entitled to set off one account against another, so as to be assessed on total trading profits and property or total interest paid on loans, whichever might be the greater. This view the Inland Revenue Authorities declined to accept; but in course of time widespread dissatisfaction led them to offer as a compromise what was termed the "Birmingham settlement," the points of which are explained. One or two London County Council cases bearing on the question are considered; and then the reader is taken to the well-known Leeds test case, which occupied the attention of the Courts a few years ago, being finally disposed of by the House of Lords, the effect of whose judgment upon the claim of the local authorities—*i.e.*, that the whole of their accounts should be pooled, and that the liability to income-tax should be based upon the total profits and property (deducting losses, if any), or upon the total interest (including the interest upon non-trading undertakings), whichever was greater—was the subject of a memorandum issued subsequently by the Incorporated Institute of Municipal Treasurers and Accountants, after consulting with the Inland Revenue Department. This memorandum is set out in an appendix to the book, as is also another one prepared by the Institute, stating certain rules, agreed with the Department, to be observed in arriving at income-tax liability of local authorities. The application of these rules is dealt with in detail; but the general effect, it is pointed out, is that pooling is admissible in regard to the various accounts forming part of each separate fund, including those of the trading undertakings secured thereon, and of which the surplus profits are, or may be, legally transferred to such rate fund. Usually, there are two funds—the borough fund and the district fund.

There is a chapter on depreciation, allowances for wear and tear, and obsolescence; and in this connection reference may again be made to the appendix, where there is set out [in parallel columns with the municipal scheme] the scheme which, as "JOURNAL" readers are aware, has been adopted by the Board of Inland Revenue for application to gas undertakings other than those owned by public authorities. This scheme has, it is stated, been carefully considered by the Council of the Institute of Treasurers and Accountants, who express the opinion that, while introducing some new features, it would, if made applicable to municipal undertakings, prove in practice of doubtful advantage to the authorities concerned. The general question of the assessment of local authorities to income-tax is fully gone into. Trading undertakings—among them gas, water, and electricity, each considered separately—form the subject of one chapter, and non-trading concerns of another. Then the adjustments and various other matters are explained; and in a concluding chapter, the authors emphasize certain anomalies, by asking several questions to which it is not easy to find a satisfactory answer.

A separate section is devoted to the elucidation of another financial problem—the excess profits duty, which has already

* "Income-Tax in Relation to Local Authorities." By F. Ogden Whiteley, F.S.A.A., and William Whittingham. William Byles and Sons, Limited, Bradford. [Price, 10s. 6d.]

been increased from 50 to 60 per cent., and from which the trading undertakings of local authorities are not exempt. This with a number of appendices, to some of which allusion has already been made, completes a book which performs a very useful function in an agreeable manner—that is to say, presents a "dry" but necessary subject in simple and readable form.

COAL FIGURES FOR 1915.

THERE has been issued, over the signature of Sir R. A. S. Redmayne (Chief Inspector of Mines), Part I. of the Home Office report on Mines and Quarries for 1915. This particular Blue-Book deals with divisional statistics, and it presents in summarized form some of the information which will be available in greater detail in Part III. of the report.

In the first place, it is stated that in the year 1915 the total output of coal in the United Kingdom from mines under the Coal Mines Act was 253,179,446 tons. Adding to this 26,635 tons from open quarries, the total output of coal was 253,206,081 tons, as against 265,664,393 tons in the previous year. Thus there was a decrease in 1915, as compared with 1914, of 12,458,312 tons; while 1914, in its turn, had an output less than that in 1913 by 21,766,080 tons. The falling off in 1915, as affecting the various districts, is referred to in the reports of the different inspectors. In Scotland, it appears, the output under the Coal Mines Act was 4,605,324 tons less than in 1914, and 8,498,791 tons less than in 1913. It is remarked that, when the number of miners who have joined the forces is taken into account—from some mines more than 50 per cent. of the total employees have enlisted—this drop in output is not to be wondered at. Employment was good; and had the railway facilities been better, more time could have been worked. The output of coal in the Northern field was 47,030,285 tons, as compared with 52,384,478 tons for the previous year; the drop being due to some extent to lack of shipping, the rise in freights, and other exporting restrictions. There was a shortage of labour of all kinds; and great efforts were made in the direction of working the more easily-gotten coal, with the result that the output per person above and below ground rose to 266 tons—the highest average for some years past. As to the York and North Midland division, the output of coal was 67,504,130 tons, against 66,807,623 tons in 1914. This increase of 696,507 tons was secured in spite of the fact that 6000 fewer persons were employed during the year. The inspector points out that these figures distinctly indicate more regular working of the mines, and do credit to those employees who, by greater effort, have increased the output of coal to assist the country in the present crisis. The proportion produced by coal-cutting machines was nearly 11 per cent. of the whole output of the division. In Lancashire, North Wales, and Ireland, there was a falling off of more than 14 per cent. in the number of persons employed; and this resulted in a corresponding diminution in the total output (25,194,857 tons) under the Coal Mines Act of 1,343,460 tons. Denbighshire, however, shows an increase of 40,126 tons. Owing to the large number of miners who enlisted in the South Wales division, there was a considerable reduction in the number of persons employed in the mines, with a corresponding falling off in the output of coal. In 1913 (the last complete year before the war) the number of persons employed in coal mines in the division was 233,134, and the total output of coal was 56,830,072 tons; whereas in 1915 the number of persons employed was 202,655, and the output of coal 50,452,600 tons. Thus there was a reduction of 13 per cent. in the persons employed, and of 11¼ per cent. in the output of coal. Lastly, there is the Midland and Southern coalfield, where, notwithstanding the decrease in the number of persons employed underground, the output of coal was 27,587,042 tons, or 156,050 tons greater than in the preceding year. This increase is attributed, to some extent, to work in the less productive seams and sections of the mines having been temporarily suspended.

The number of mines at work during 1915 under the Coal Mines Act in Great Britain and Ireland was 2871 and of persons employed under and above ground 953,642. In the preceding year, owing to the outbreak of war, the figures were taken at two periods. There were 2988 mines working during that year; and for the period from January to July 1,133,746 persons were employed. By the last pay-day in December of that year, however, this total had shrunk to 981,264. Of last year's figure of 953,642, 754,673 persons were employed underground.

There were in 1915 accidents in mines working under the Act which caused 1297 deaths, as compared with 1219 the previous year. The figure for 1915 represents a death-rate of 1·36 per 1000 persons employed in mines, and of 4·9 from all accidents per 1,000,000 tons of mineral raised.

In America, the election of officials of Associations is apparently not participated in by the ordinary members to a greater extent than is usual in England. Rumour says that with us hardly ever is a majority of the issued ballot-papers ever returned by those entitled to vote for the Council of (say) the Institution of Gas Engineers. For this year's ballot of the American Gas Institute 898 ballot papers were sent out. Of these, 487 only were received correct and counted. For some cause or other 42 papers had to be rejected; so that 369 members "distinguished" themselves by not voting.

RISE AND DEVELOPMENT OF BYE-PRODUCT COKING.—II.*

[COMMUNICATED.]

ERECTION OF BYE-PRODUCT COKE-OVENS.

MANY different systems of bye-product coke ovens are now in successful operation in this country; and the choice of a particular system is a matter only to be decided by the special circumstances of each individual case. The following systems can be seen in operation in Great Britain: Coppée, Simon-Carvès, Semet-Solvay, Otto, Koppers, Still, Huessener, Collin, Simplex.

The main points of difference between the various systems may be summarized as follows: (1) The arrangement of the heating flues; (2) facilities for inspecting all working parts of ovens; (3) method of regulating and controlling heating of ovens; (4) preheating of air required for combustion.

The essential features of a good coke-oven may be stated, briefly, as follows: The heating of the ovens must be easy to regulate and control, and should allow of the temperature being kept as nearly constant as possible throughout the whole length of the oven wall, in order to produce a homogeneous coke. Ample means for controlling both the gas and air supplies should be provided. All working parts of the oven should be easily accessible for inspection and regulation, and without discomfort to the workmen. The amount of gas required for heating the ovens should be reduced to the minimum; and the largest possible amount of surplus energy should be produced without decreasing the output of bye-products. The heating of the ovens should be such as will enable the maximum yield of bye-products to be obtained. To secure this, it is essential that the crown of the oven should not be too strongly heated, as otherwise the bye-products will be further decomposed by the passage of gas through the hot space above the coal. The heating must further extend along the full length of the oven walls, so as to completely carbonize the whole charge and avoid the production of black ends.

The material composing the structure of the ovens, especially of those parts which are subjected to heat and pressure, should be of first-class quality. The lining of the oven and the heating flues particularly should be built of bricks which are tongued and grooved and well set together, so as to do away with all possibility of leakage of gas from the ovens to the heating flues, and *vice versâ*. The inside of the oven walls must be exactly square with the front of the ovens, and there must be no projections, as otherwise damage will certainly be done when the coke is discharged from the ovens. There will also be difficulty in charging compressed coke. The ovens should be of substantial construction, but simple in design, in order to facilitate repairs.

A modern coking plant covers a large ground area; and the layout of the installation is a matter which calls for very careful consideration. The economical arrangement of the various sections of the work has to be considered, as well as the employment of the best methods of construction of the buildings, ironwork, machinery, &c. To take, for example, a complete bye-product coking installation of (say) 100 ovens, this involves a coal consumption of about 600 tons per day; and, in addition to the coke, the bye-products recovered are tar, sulphate of ammonia, and benzol. The designer of the plant has therefore to consider principally the following points:

1.—The supply of coal to the coke ovens.
2.—The removal of the coke from the ovens.
3.—The handling of the gas, tar, sulphate of ammonia and benzol.

It is important that the approximate quantities of each product which will have to be dealt with should be known fairly accurately; and for this purpose all coke-oven builders themselves make tests on representative samples of the coal to be carbonized. From these tests are determined the quantity of coke, the total yields of gas, tar, sulphate of ammonia, and benzol; the amount of ammoniacal liquor likely to be produced, the relative proportions of free and fixed ammonia (and hence the amount of lime required for distillation of the liquor), and also the sulphuric acid which will be required for sulphate making; and the sizes and capacities of the various pipes, mains, tanks, pumps, exhausters, and other machinery.

Generally, the ovens are situated near to the colliery; and it is desirable that the site should be such as will permit of an economical arrangement for the delivery of the coal to the ovens, and will at the same time necessitate only a minimum amount of excavation for the foundations of the plant. In some cases the coal can be taken directly from the pit in tubs and delivered into the hoppers of the washery, and thence, by means of conveyors, be deposited in the coke-oven storage bunker. In other cases, circumstances compel the site to be chosen at some little distance from the pit; and hence much more handling of the coal is entailed. This necessarily means additional expense; and the aim of the designer is to minimize this as much as possible, while at the same time providing an efficient and reliable means of transport. Occasionally an aërial ropeway is supplied, which method of handling coal has much to recommend it. Perhaps its chief disadvantage is its primary cost; but when it is remembered

* The first article of the series appeared in the issue of the "JOURNAL" for Oct. 17, p. 126.

what it saves in the way of trucks, sidings, labour, ground space, &c., this disadvantage is more than counterbalanced.

It is very desirable to be able to arrange the plant in as compact a manner as possible, but without unnecessary crowding, thereby economizing ground space and also diminishing the lengths of pipes, mains, &c., required for the conveyance of the various products of distillation. As far as possible, all pipe-lines should be placed above the ground or in boarded trenches to facilitate inspection, cleaning, &c.; but due protection against inclement weather conditions must be made. The foundations of the ovens require special care. The nature of the subsoil must be well determined, as should any subsidence take place, serious damage would be done to the ovens. In some instances the ovens are laid on a concrete base of varying thickness; while in others, concrete piles have been driven in order to obtain a sufficiently firm foundation. The position of the site with regard to railway facilities has to be considered in those cases where the producers are not also the consumers of the coke. Ample siding accommodation is necessary, so as to avoid congestion and consequent delay in getting the coke and other products away. The type of power to be employed, the machinery, pumps, &c., all need careful consideration; but it is impossible to generalize on these things, each particular case having to be considered on its own merits.

The type of oven—apart from the make—to be installed has to be considered in connection with possible future developments. Most oven builders offer two types of ovens—viz., the waste-heat oven and the regenerative (or the recuperative) oven. In the waste-heat oven, the heating gas is supplied with cold air for combustion, and the hot waste gases resulting from the combustion are led away by means of a flue to a range of steam-boilers, where the surplus heat is utilized for steam-raising. This is the only way in which the surplus energy contained in the coal carbonized in waste-heat ovens can be recovered. In the regenerative type of oven, the air for combustion is preheated to a high degree in regenerator chambers of the Siemens type, and consisting of chequer brickwork. [The construction and working of a modern regenerative oven will be described later.]

The heat contained in the hot gases of combustion is used for preheating the air supply to the ovens, and hence indirectly helps to heat the ovens themselves. Consequently, a smaller amount of gas is required for heating regenerative ovens than is necessary for heating waste heat ovens. Hence the surplus supply energy of the coal when carbonized in regenerative ovens is available in the form of a combustible gas, instead of as a hot incombustible gas as in the waste-heat oven. With both types of ovens, equal results are obtained as far as the quantity and quality of the products are concerned. It is generally stated that where the surplus energy of the plant is required in the form of steam, waste-heat ovens should be built, but that where gas-engines are employed regenerative ovens should be erected. This, however, does not necessarily give the best method, for the following reasons. Where waste-heat ovens are employed, the surplus heat from the ovens must be utilized at once, before the gases have time to cool. The boilers where the heat is abstracted must be in close proximity to the ovens, or much heat is lost in transit, owing to radiation and other causes.

It is not always convenient to have the boilers so near to the ovens, particularly on collieries where the ovens are some distance from the pit head. With regenerative ovens, on the other hand, the surplus energy is produced in the form of a combustible gas. This gas can be conveyed any distance, and can be stored for any length of time without deteriorating at all. If used under the boilers, the gas will raise practically the same amount of steam as would the waste heat from an equivalent battery of waste-heat ovens. In order to develop the maximum amount of power, combustion in gas-engines is by far the most efficient method.

Approximately the cost of the regenerative oven is about 10 or 15 per cent. more than that of the waste-heat oven. On the other hand, the regenerative oven presents certain working advantages in that it can be "slowed" to almost any extent and easily brought up to full load again, as the regenerators act as an efficient store for heat. The regulation of ovens of the regenerative type is generally under much better control. In recent years the tendency is certainly in favour of the regenerative construction; and with the rapid development of large gas-engines, gas-fired boilers, and other means of economically consuming coal gas, it is almost certain that the regenerative type will continue to predominate in new installations.

An instructive comparison on a power basis can be made between waste-heat ovens and regenerative ovens by considering the outputs of a typical installation of each type. Consider, for instance, (*a*) fifty waste-heat ovens and (*b*) fifty regenerative ovens of the same carbonizing capacity. Each battery would carbonize approximately 300 tons of coal per day. The determination of the available energy of waste-heat ovens is a matter of experience only; and it is found that approximately 320 tons of steam a day could be obtained from fifty waste-heat ovens. Assuming that the steam-engine used to develop the power consumes about 22 lbs. per B.H.P. hour, the power obtainable would be $\frac{320 \times 2240}{22 \times 24} = 1360$ B.H.P. per day.

With regenerative ovens, the yield of surplus gas per ton of coal would be about 5500 cubic feet, of a calorific value of approximately 500 B.Th.U. Utilizing this gas under boilers with efficient modern burners, practically the same amount of steam could be obtained as in the case of waste-heat ovens. The better method of utilizing this gas for power production is undoubtedly by internal combustion engines. Large gas-engines utilize about 20 cubic feet of gas (the equivalent of 10,000 B.Th.U.) per B.H.P. hour, and give thereby, on the above basis, a power production of

$$\frac{5500 \times 300}{20 \times 24} = 3437{\cdot}5 \text{ B.H.P. per day.}$$

British engineers have not taken too kindly to very high-power gas-engines; but builders are busy with orders for engines of about 500 H.P. It can be safely stated, however, that the principal difficulties associated with high-power engines on coke-oven plants have now been largely overcome. Tar and naphthalene formerly caused much trouble with valves; but modern methods of extraction easily cope with this. The cleaning plants, dust extractors, &c., have been brought to a high state of perfection, owing to the vast experience gained with installations in connection with blast-furnace plants.

One of the early difficulties in connection with the use of coke-oven gas for large engines was the liability to pre-ignition, owing to the large proportion of hydrogen contained in the gas. By careful attention to the compression, this difficulty has been moderated considerably. The design of engines to run on coke-oven gas requires no small amount of care, owing to the quality of the gas. In the modern engines, however, efficient scavenging arrangements are incorporated; and the engines are capable of running for a long period, even when considerably overloaded. Originally, engines with variable compression, or "quantity regulation," were tried. With this type of regulation, the mixture of gas and air always remains constant. But the quantity of mixture admitted to the cylinder is changed to suit the load; and the compression varies with the quantity of mixture. Such regulation can only be satisfactory where the condition of gas and air and speed are constant. After a short trial, this method of control was discarded by leading makers, and "quality regulation" was substituted. Constant compression, or "quality regulation," was successful from the beginning; the speed of the engine under varying loads being adequately controlled, and variations in gas and air being satisfactorily dealt with.

Parallel with the development of the gas-engine is the marked progress which has been made in the production and use of steam; and this will commend itself to those who prefer to remain constant to a well-tried servant. With the newest type of burners, gas-fired boilers are considerably more efficient than they were a few years ago. For those collieries which already possess a complete steam equipment, the steam plant will be more suitable, as conversion to electric power would be an expensive item. In new collieries and coke-oven plants, one expects to see more and more use made of electric power. The surplus gas from the coke-ovens can be consumed in large gas-engines, and these, coupled direct to generators, will supply electricity for the power required both at the colliery and at the coke-ovens.

In a later article it is proposed to deal in detail with power production on coke-oven plants; and the question of steam-engines *v.* gas-engines will be considered.

THERMAL PROBLEMS FOR GAS ENGINEERS.

XII.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

Incidental Wastage attendant on Combustion.

The practicability of utilizing the whole of the heat produced by the combustion of the fuel in connection with technical processes is the exception and not the rule. The calorimeter, gas-heating stoves not fitted with flues, and the open type of geyser, are examples that do not leave much margin for further economy of heat. But as regards the majority of applications, whether for domestic or manufacturing purposes, there is a wastage or loss of heat from various causes, such as the escape of hot products of combustion at the top of the chimney, the work done in creating the necessary draught, incomplete combustion, loss by radiation and convection from the exterior surface of the furnace, and the temperature limit. Some of these are unavoidable; but all are more or less under control, and may be considerably reduced by competent design of apparatus to suit the required purpose.

If supplies of cheap fuel, perhaps useless for other purposes, are available, economy in respect to some of these lines may not be worth the candle. But at the present time, when all kinds of fuel are uncertain and costly, and there are reasons for exercising conservation of fuel to the greatest extent possible, they call for serious consideration.

Hot Products of Combustion.

When hydrogen is one of the constituents of the fuel, the products of combustion must escape at a temperature of not less than 212° Fahr., in order to avoid condensation of water in the chimney—incidentally carrying away an appreciable quantity of heat represented by the latent heat contained in uncondensed steam. The alternative is a device for collecting condensed water, such as the pan placed at the base of a gas condensing stove. In an open type geyser, the products of combustion may be cooled nearly to atmospheric temperature, and the steam condensed and retained by the water. Gas engineers are familiar with the inconvenience

caused by accumulations of rust or moisture in sheet-iron flue-pipes of any considerable length, large in diameter as compared with the work to be done, or in exposed situations; and as a rule there is no convenience for the condensation of water in the ordinary chimney. A flue may be defined as a conduit that allows the contents to escape at the outlet at a temperature of not less than 212° Fahr. Anything that does not comply with this condition is a condensing chamber, and should be supplied with an outlet for accumulated liquid.

The case is met in the general way by the assumption that it is necessary that the products should escape at a temperature above the limit named, in order to create the necessary draught. But as much has never been proved; and there is room for investigation on the subject of natural *versus* artificial draught.

A carbonaceous fuel, such as coke or anthracite, offers several advantages for raising steam, as compared with bituminous coal or other fuels that are fairly rich in hydrogen. The products of combustion are "dry," and their specific heat is less. The point may be illustrated by considering the application of pure carbon and of pure hydrogen respectively, as a fuel for raising steam.

A pound of pure carbon will require for complete combustion 2⅔ lbs. of oxygen or 11⅔ lbs. of air, and the products will be 3⅔ lbs. of carbonic acid together with 9 lbs. of nitrogen, which passes through the furnace unaltered and serves no useful purpose apart from a diluent that reduces the initial temperature of combustion, which with pure oxygen might be so high that ordinary materials would not stand it. The nitrogen is therefore not altogether useless, and as much may be said of a moderate excess of air. The heat carried away by the products of combustion will be:

$$3{\cdot}66 \times 0{\cdot}2163 \times 300 = 238$$
$$9{\cdot}00 \times 0{\cdot}2438 \times 300 = 658$$
$$896 \text{ B.Th.U.} \quad 6{\cdot}1 \text{ per cent.}$$

The available heat of carbon is therefore 14,650 − 896 = 13,754 B.Th.U. The initial temperature of combustion with air:

$$\frac{14{,}650 \times 300}{896} = 4900° \text{ Fahr.}$$

The initial temperature of combustion with oxygen:

$$\frac{14{,}650 \times 300}{238} = 18{,}468° \text{ Fahr.}$$

These calculations are based on the specific heats of gases at ordinary temperatures; but a large deduction should be made on account of the increased specific heats at high temperatures, which would have the effect of bringing the initial temperature much lower than the figure named. This illustrates the useful effect of nitrogen or other suitable diluent in the furnace.

For complete combustion, 1 lb. of hydrogen requires 8 lbs. of oxygen or 35 lbs. of air; and the products are 9 lbs. of water and 27 lbs. of nitrogen. The heat carried away by the products of combustion will be:

$$9 \times 0{\cdot}4805 \times 300 = 1297$$
$$9 \times 938 = 8442 \quad \text{(the latent heat of uncondensed steam).}$$
$$27 \times 0{\cdot}2438 \times 300 = 1973$$
$$11712 \text{ BTh.U.} \quad 19 \text{ per cent.}$$

The available heat of hydrogen is: 61,885 − 11,712 = 50,173 B.Th.U. The initial temperature of combustion with air, subject to the reservation above named, will be:

$$\frac{50{,}173 \times 300}{3270} = 4600°.$$

Or with oxygen:

$$\frac{50{,}173 \times 300}{1297} = 11{,}605°.$$

The available heat of carbon per pound of air consumed is $\frac{13{,}754}{11{\cdot}66} = 1180$ B.Th.U., and of hydrogen $\frac{50{,}173}{35} = 1434$ B.Th.U.

Notwithstanding the disadvantage of the high specific heat of the products of combustion, and contrary to a very general supposition, hydrogen retains the lead as an economic consumer of air as compared with the heat produced. Although it requires, for equal weights, three times as much air as carbon, it produces 4·2 times as much total heat, and nearly 3·7 times as much available heat. But as regards initial or flame temperature, carbon retains an advantage.

As a second illustration, suppose the fuels to be used for heating a retort or crucible to a high temperature, and that the products of combustion escape at 2000° Fahr. Those from carbon will carry off:

$$12{\cdot}66 \times (2000 - 60) \times 0{\cdot}293 \text{ [VII]} = 7044 \text{ B.Th.U.}$$

leaving as available heat 14,650 − 7044 = 7606 B.Th.U., 52 per cent., or 600 B.Th.U. per pound of air consumed.

Those from hydrogen will carry off

$$9 \times 0{\cdot}6 \times (2000 - 60) = 10{,}476$$
$$9 \times 938 = 8{,}442$$
$$27 \times 0{\cdot}27 \times (2000 - 60) = 14{,}143$$
$$33{,}061 \text{ B.Th. U.}$$

leaving as available heat 61,885 − 33,061 = 28,824 B.Th.U., 47·4 per cent., or 823 B.Th.U. per pound of air consumed.

At low temperatures, the proportion of available heat is largely in favour of carbon; but as the temperature increases, the advantage is reduced.

Incomplete Combustion.

This may be evidenced either by the presence of partially consumed gases in the products of combustion, or by the existence of combustible matter in the ash or clinker removed from the ash-pit. An examination of this question must therefore not only include an analysis of the products of combustion, but also of the contents of the ash-pit, which usually include fragments of almost untouched fuel that have accidentally found their way through without exposure to the heat of the furnace. Some fuels tend to disintegrate under heat, others are friable and easily crushed; and if the bed of fuel is deep, as in a cupola or a full-depth regenerator furnace, a considerable quantity of combustible matter may filter its way through.

The fusibility of the ash plays an important part. An ash that comes down in the form of a finely-divided dust may be practically free from combustible matter, but one that fuses into large lumps may retain a considerable proportion. The zone of high temperature should not extend down to the furnace-bars. Steam or water is commonly applied at this point, with a view of keeping the bars cool and facilitating the separation of clinker; and with a similar object in view the openings in a step-pattern grate are "ashed up." The object is to cool the ash as soon as it is completely free from combustible matter, but not before. If the cooling is too energetic, or extends too far up into the furnace, loss may be caused by the cooling of combustible matter to a temperature lower than that required to ensure combustion.

Confusion occasionally arises when comparing the combustible value of gaseous with those of solid and liquid fuels, because the first named must necessarily be purchased by measure, usually cubic feet, but solids are invariably supplied in terms of weight, and liquids either by weight or measure, according to the custom of the trade. There may be some difficulty and liability to error in reducing 1 lb. of coal or coke, 1 gallon of oil, and 100 cubic feet of gas to one common basis for comparison. This difficulty has led to a general preference for terms of weight, when such are practicable. They are usually adopted for solids and liquids, and would no doubt be extended to gases if a convenient method of selling this form of matter by weight was practicable. Seeing that the combining proportions, the specific heats, and other properties are usually expressed in terms of weight, it is convenient to reduce all fuels to this basis.

The fuels in general use, which comprise the different varieties of coal, coke, oil, petroleum, producer gas, and town gas, depend for their combustible properties on carbon, hydrogen, or compounds of the two, and range from practically pure carbon to a half-and-half mixture. Their heating values therefore all come within the limits of pure carbon, 14,650 B.Th.U. per pound weight, and $\frac{14{,}650 + 61{,}885}{2} = 38{,}268$ B.Th.U., and this is exclusive of the diluting effect of the incombustible matters that are also present. Gas engineers are accustomed to talk of the comparatively high calorific values of the heavy hydrocarbons; but this only applies to bulk, and is due to the high densities or specific gravities of the vapours of these substances. Benzene is 39 times as heavy as hydrogen, pentane 36, naphthalene 64, &c. [Table III., "Journal," July 18, p. 113]; but, taken by weight, some of them do not greatly exceed the value of carbon, and the highest (methane) is 24,169 B.Th.U. per pound [Table VIII., "Journal," Aug. 22, p. 346].

(To be continued.)

Benzol and Toluol Extraction at Falkirk.

A deputation from the Rothesay Town Council last Thursday visited the Falkirk Gas-Works, to inspect the methods which have been put in operation there by Mr. William Wilson (the Engineer and Manager) for the extraction of benzol and toluol for the manufacture of explosives. Already the process—which is that of oil-washing—has been adopted at the gas-works of Stirling, Peebles, Dunfermline, Perth, Montrose, and Kirkintilloch. The Rothesay Gas-Works are of the moderate size of works for which the Ministry of Munitions have found Mr. Wilson's process to be specially suited; and it is likely to be adopted there also. The particular feature is a still for extracting the spirit out of the oil which has been patented by Mr. Wilson, and which was the outcome of numerous experiments. Since January, when the present plant was put into operation, uniformly excellent results have been obtained; and Mr. Wilson's valuable pioneer work, so far as Scotland is concerned, has been recognized by his appointment by the Ministry of Munitions to be Supervisor in their interests for the Central District of Scotland.

On Thursday last, the Naval Commissioners representing the Board of Inventions and Research—consisting of Sir Geo. Beilby, Admiral Sir R. Sears, Sir Alfred Parsons, Dr. Harker, Commander Bridge, R.N., and other experts—visited the low-temperature carbonization plant at Battersea, where everything was explained by Mr. F. D. Marshall and Mr. C. W. Tozer. The inspection lasted two hours; and the Commissioners were deeply impressed by all they saw, going into every detail most thoroughly.

COMMON OFF-TAKE PIPES FOR RETORT-SETTINGS.

Further American Proposals.

Under date of the 2nd ult., Mr. R. S. Congdon, the Manager of the Atlanta (U.S.A.) Gaslight Company, writes in reference to the article appearing with the above heading in the "JOURNAL" for July 11, pp. 73-75.

Mr. Congdon says there is now-a-days a great deal of interest shown in various types of coal-gas apparatus. Many engineers still cling to horizontal—especially through horizontal—retorts, in preference to ovens or vertical retorts. To these engineers the subject of common off-take pipes is most interesting. The article referred to in our July 11 issue would, it seems to him, give rather a discouraging aspect of this common off-take pipe arrangement. He therefore sends additional information to enable us to represent a more complete idea of the entire development.

Mr. Congdon adds: "I fancy many engineers on your side of the water, as well as in America, would view with apprehension the valves depicted in the engraving at the lower right-hand corner of p. 73. The drawing shown is the original one which accompanied my first application for a patent. I, however, was not allowed the arrangement as shown in this drawing, in so far as it pertains to connecting a horizontal row of retorts with a stand-pipe. Connecting the retorts in a horizontal row and to a stand-pipe is covered by a patent granted to Fowler, in this country. The Patent Office would allow me only one retort in each row connected to a stand-pipe. In this drawing, the valves indicated were merely to show that a valve would be used."

Mr. Congdon forwards a copy of his second patent specification No. 1,099,639, which shows the final development of the valve used to shut off connection between the retort and stand-pipe. This patent [reproduced later] covers: (1) A stand-pipe sealed top and bottom, making lateral communication to retorts in a vertical row; (2) valves placed inside the stand-pipe opposite each retort stand-pipe connection; (3) means for passing water or other liquid down the stand-pipe on to the valves and past the retorts; and (4) means for returning the liquid to the upper end of the stand-pipe. The patent drawing shows the retorts connected to both sides of the stand-pipe—the arrangement used at Atlanta to-day. Mr. Congdon says he prefers, however, two stand-pipes, as shown by Rowland and Hansen (an English inventor), because with two pipes the usual eye-beam buckstay may be used. The stand-pipes can be placed closer to the retorts; and where there are two pipes to a bench, the latter can be cut out by merely raising the upper seal. Where there is one pipe between two benches, this cannot be done.

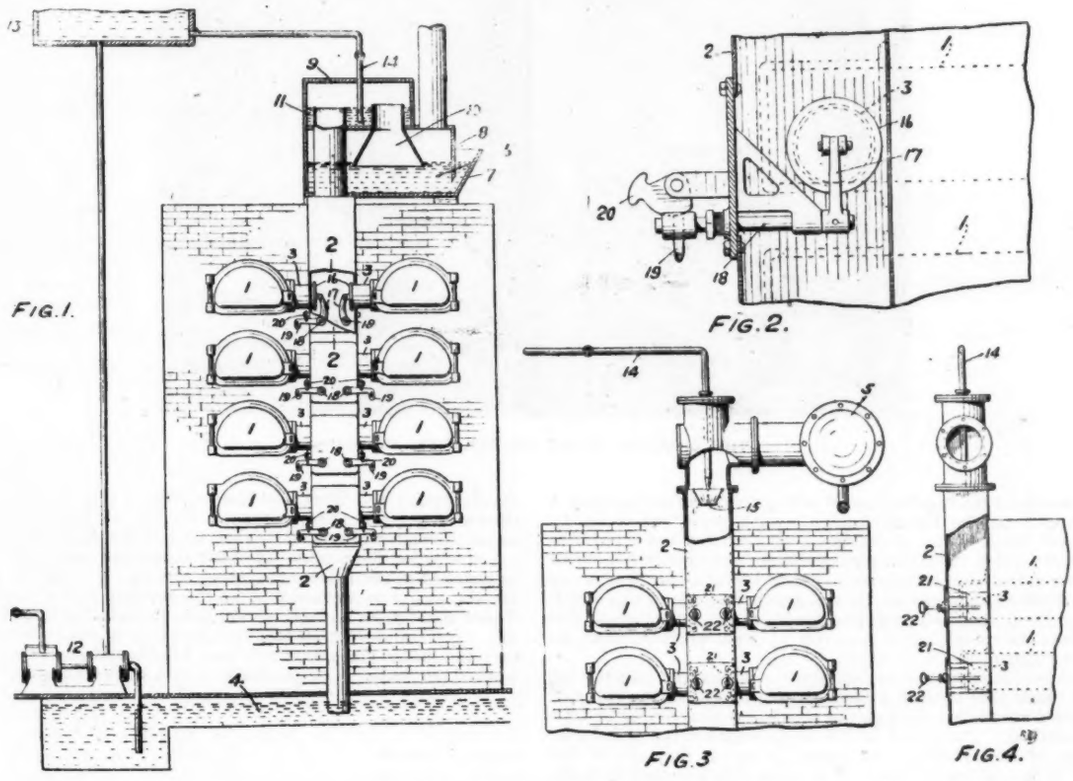
Congdon's Second Patent of 1914.

This patent (No. 1,099,639) was applied for on March 14, 1914, and granted the following June 9. The filed specification is as follows:

The principal objects of the invention are to prevent the accumulation of tar, pitch, and lamp black inside the stand-pipe; to scrub the gas in the stand-pipe, and thus lessen the burden on the balance of the works; to increase the capacity of the exhausters, condensers, and scrubbers; to rapidly cool the gas inside the stand-pipe; to provide for disestablishing communication between the stand-pipe and any retort or retorts, while being charged or drawn, by means of a valve or valves which remain clean and operative; to obviate the expense, annoyance, and work of cleaning the stand-pipe at frequent intervals by manual or mechanical means; and to reduce the first cost of the installation while attaining the advantages recited.

These objects are accomplished by the downward circulation of water, water-gas tar, or other fluid inside the stand pipe, but without getting it inside the retort or retorts connected to the stand-pipe, in combination with the ascension of the gas through the stand-pipe and with the arrangement of valves inside the stand-pipe, so that they are kept clean by the descending fluid.

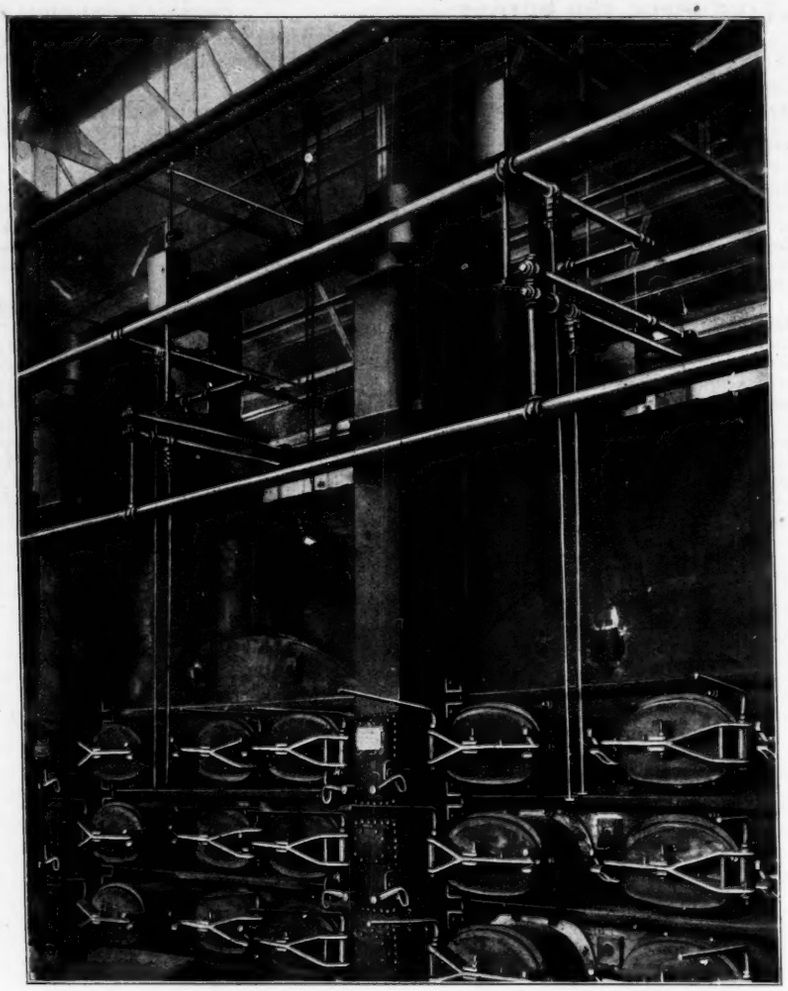
Fig. 1 is a front view with parts broken away (and partly diagrammatically) illustrating one form of the apparatus. Fig. 2 is a sectional view, taken on the line 2 of fig. 1 (to an enlarged scale). Fig. 3 is a front view of another form of apparatus embodying a modification of the invention. Fig. 4 is a side view (with parts broken away) of the apparatus shown in fig. 3.



CONGDON'S PATENT OFF-TAKE PIPE FOR RETORT-SETTINGS.

1 are retorts for the manufacture of coal gas. 2 is a stand-pipe in communication with each of the retorts and extending above and below them. The gas from the retorts passes upward through the stand-pipe and is let off at the top. The retorts communicate with the stand-pipe by branch 3. There are means for discharging water, water-gas tar, or other fluid, preferably in a divided state like spray, downward through the stand-pipe. Within the stand-pipe are valves for establishing and disestablishing communication between the interior of the retorts and the stand-pipe.

The descending liquid or fluid performs several important functions: It keeps the stand-pipe clean, which is a matter of the utmost importance and value, as will be understood by those skilled in the art; it scrubs and cools the ascending gas, so that the rest of the apparatus (not shown) is relieved of this work, thus increasing the capacity of the plant and reducing the first cost of installation; and it keeps the valves clean, so that they can be readily operated when it is necessary or desirable to establish or disestablish communication between the retorts, or any of them, and the stand-pipe. After descending through the stand-pipe, the liquid or fluid is collected in a trough 4, into which the lower ends of the stand-pipes dip, so that the escape of gas at their lower ends is sealed off and prevented. At the top of the stand-pipes the gas



THE CONGDON PLANT AT ATLANTA, GEORGIA.

may be led off directly into an off-take pipe or collecting main 5 (fig. 3), or it may be led off through a wash-box or seal 6 (fig. 1). The wash-box is shown as consisting of a tank 7 and a cover or bell 8, with which the stand-pipe communicates by way of a closed chamber 9 and connection 10. Within the chamber 9 is space which receives fluid (as at 11) which overflows down the stand-pipe for the purpose already described. 12 is a pump which lifts fluid from the trough 4 to a reservoir 13, from which it flows by a valved pipe 14 to the space 11.

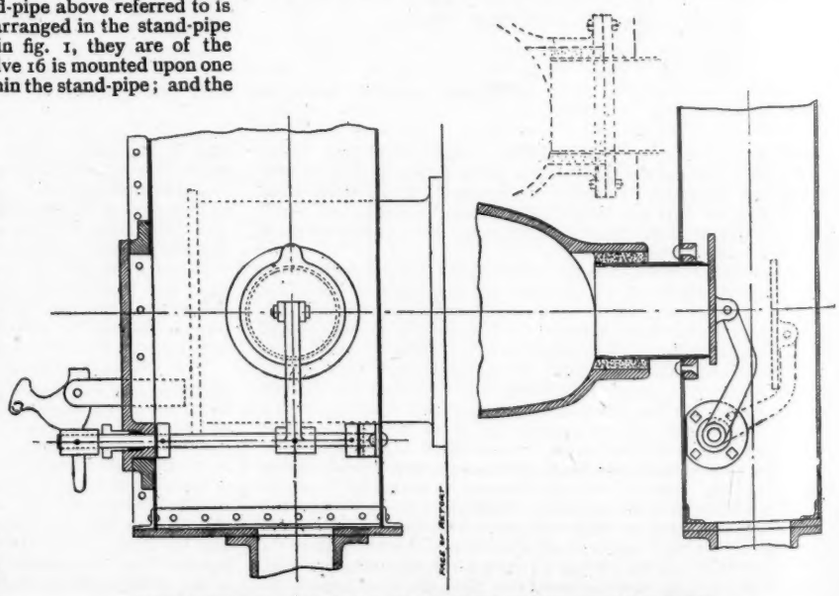
As shown in fig. 3, the valved pipe 14 discharges into the top of the stand-pipe against a baffle-plate 15; and so the spray or downward circulation through the stand-pipe above referred to is accomplished. The valves which are arranged in the stand-pipe may be of any variety. As shown in fig. 1, they are of the "flap" type, and are all alike. The valve 16 is mounted upon one arm 17 of a rock-shaft 18 arranged within the stand-pipe; and the other arm 19 is arranged on the rock-shaft 18, but outside the stand-pipe, so that it is accessible from the outside. The latch 20 is pivoted to a bracket, and adapted to be turned down over the arm 19 so as to hold the valve 16 in its closed position and to be turned up clear of the arm 19 to permit the valve 16 to be opened.

The valves in figs. 3 and 4 are arranged inside the stand-pipe. These valves 21 are slide valves provided with handles 22, which extend through the wall of the stand-pipe, and they are slid in and out so as to cover and uncover the opening in the branch pipe 3.

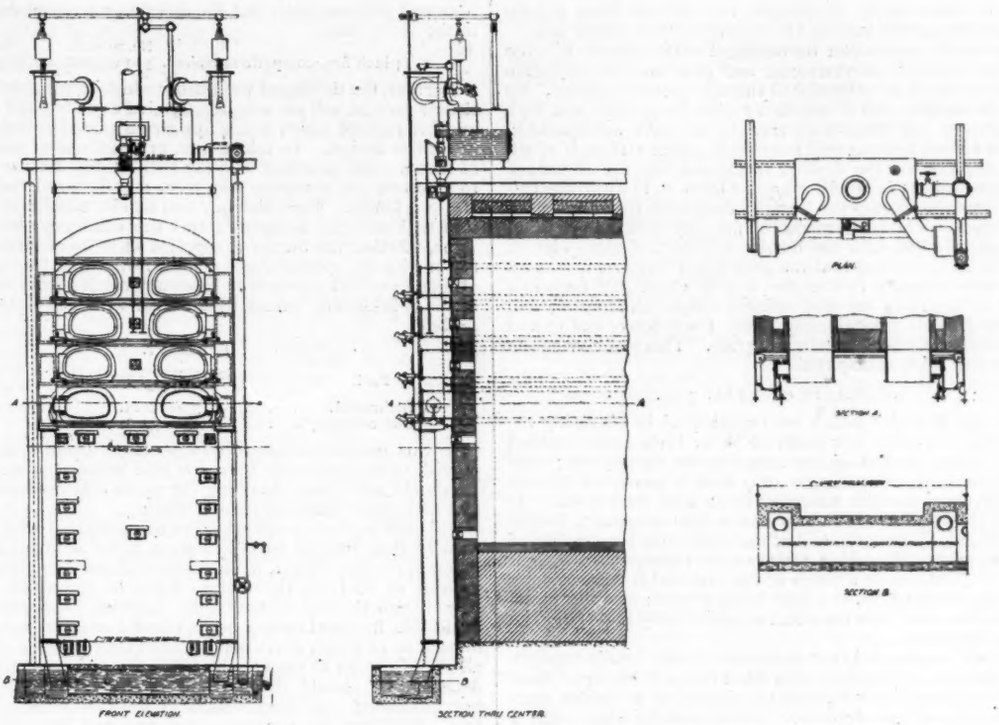
The Congdon Scrubber Stand-Pipe Valve Arrangement.

Mr. Congdon also forwards illustrations and particulars of his scrubber-stand-pipe system, as arranged inside the stand-pipe; also the apparatus applied to a bench having two stand-pipes—see p. 179. This is the last development; and from it readers will note that the illustration shown on p. 73 of the "JOURNAL" for July 11 (lower right-hand corner) does not give a really clear idea of this final idea.

Yet another illustration he sends shows the actual apparatus, as installed in the Atlanta gas plant to-day. The middle retorts are connected to a stand-pipe on the opposite side of the bench. These stand-pipes have, it is said, been in operation since December, 1913, and during all this time have never been cleaned—in fact, the bridge-pipes have not been raised, and the valves have worked perfectly. The gas passes into a wash-box and then into



THE CONGDON SCRUBBER STAND-PIPE VALVE ARRANGEMENT.



THE CONGDON SCRUBBER STAND-PIPE SYSTEM.

an overhead collecting main. These wash-boxes have also remained perfectly clean and have required no attention.

Plants using these patented stand-pipes, besides that located at Atlanta, are at Philadelphia and Taunton, Mass; while installations in several other cities in America are at the present time under construction.

In conclusion, Mr. Congdon writes: With stand-pipes of this design, and rigged up as shown, it becomes thoroughly practical to handle the gas from a great number of retorts arranged in a vertical row. This new design opens up new possibilities for horizontal retorts; and no doubt English engineers will be interested, as have engineers in America.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

The Opening Meeting of the Association for the present session was held on Saturday afternoon, in the Heriot-Watt College, Edinburgh—Mr. J. J. Scott (Lower Larbert) presiding.

The President thanked the members for electing him for a second term as President. He referred to the death of the leader of their industry, Sir Corbet Woodall, who, he said, was Governor of the largest gas undertaking in the world, to which position he had risen by his own hard work. His whole life would stand as an incentive to every member of the gas industry. Then he drew attention to the syllabus for the session. They began that day with a lecture by Mr. Harold Hartley. Following fixtures were: A paper at Kirkcaldy, by Mr. D. Campbell, on "Retort-Bench Extensions and Drainage Difficulties;" a visit to the Galashiels Gas-Works, and a paper by Mr. R. J. Gavin, on "Sulphate of Ammonia;" a visit to the Cupar Gas-Works vertical retorts; a visit to the Dundee tar distillation works, and a paper by Mr. R. S. Johnston, on the "Commercial Side of Gas-Works Business;" a joint visit to Falkirk with the Western Juniors; and the annual meeting, with a paper for discussion. He urged all honorary members and gas managers within the area to help the work of the Association by encouraging eligible employees to join, and also by their presence at the meetings. He acknowledged the interest shown by the senior gas managers. The session's work before them indicated "business;" and with the strenuous days ahead, in which every man would be obliged to "come up to the scratch," it seemed absolutely necessary that they should make the most of their meetings and visits.

Construction of the Gas-Fire.

The President, calling on Mr. H. Hartley, of the Richmond Gas Stove and Meter Company, to deliver a lecture on the "Construction of the Gas-Fire," said Mr. Hartley's name was closely associated with the work which constituted the title of his lecture. To such men the gas industry was very greatly indebted for the successful development of the gas-fire.

An account of Mr. Hartley's lecture follows.

Increase in the Gas Light Company's War Bonus.—The Directors of the Gas Light and Coke Company last Friday resolved, in view of the high prices now obtaining for food—mere especially in London—to increase the weekly war bonus from 7s. to 10s.

GAS-FIRE CONSTRUCTION.

By Harold Hartley, M.Sc., Head of Research Department and Chief Chemist to the Richmond Gas Stove and Meter Company, Limited.

[Extracts from a Lecture delivered to the Scottish Junior Gas Association—Eastern District—Oct. 21.]

After enumerating the parts of a gas-fire, Mr. Hartley proceeded to consider them in detail, and to examine their functions—beginning with the silent gas-air adjuster which was described and illustrated in the lecture delivered by him to the Yorkshire Junior Gas Association in 1913.* Some of what followed was necessarily on the same lines as matter contained in the lecture on "Gas-Fire Development, 1913-15" which Mr. Hartley delivered last November to the London and Southern District Junior Gas Association;† and to this readers are referred for the portions which are now omitted.

Burners.

On the subject of burners, the lecturer said it has been contended recently that it is desirable to obtain a high degree of aëration; and this ensures an increase in radiant efficiency. But the contention does not hold with the existing types of gas-fire. High aëration is not essential to the satisfactory working of gas-fires, nor, so far as our present knowledge of the subject allows us to say, is it advantageous. The degree of aëration necessary is determined at present by that required to prevent the sooting-up of the radiants. Even a highly aërated flame may still cause a darkening of the radiants. Sooting-up can be prevented by having in the flame when the fire is hot a defined inner cone which is not broken-up by the fuel. This condition does not demand very high aëration.

Under the ordinary condition of use, the quality of the gas supplied as well as the pressure may vary, with the result that it is found at times that the relative degree of aëration of the flame of a given gas-fire has changed without any alteration having been made in the adjustment of the fire. With the majority of gas-fire burners in use a few years ago, such a change in the degree of aëration was often sufficient to make a flame noisy, which was otherwise silent. For this reason it is desirable to have a burner capable of producing a silent flame at all degrees of aëration.

Flame silence, just as jet silence, would appear to be dependent upon the elimination of objectionable eddies from the gas stream.

* See "Journal," Vol. CXXIV., p. 517. † *Ibid.*, Vol. CXXXII., p. 382.

This can be done simply by passing the mixture down a sufficiently long tube, or by making the burner-body of ample size.

Although flame silence can be obtained with a burner of large capacity, the article is cumbersome, and possesses the objection that when the flame is extingnished there is a noisy explosion. To eliminate the eddies, and if necessary give flame silence at high aëration without the firing-back trouble, we have introduced in the gas-fire burner a metal grid built-up of plates 1/16 inch apart. This device produces the desired result, and has the advantage that the spaces in the eddy-filter are so large as to avoid the collection of dust drawn into the burner, along with the primary air in the passages. The small pieces of fire-clay which may at infrequent intervals fall into the burner will not interfere with its working, owing to the fact that the grid has a large surface area. I had occasion recently to examine a grid which had been in a burner in a gas-fire in my own office for eighteen months; and though the office is exceptionally dusty I was interested to find that no dirt at all had collected in the grids. This result was even better than had been anticipated.

Radiants or Fuel.

Owing to the difficulty which we experienced in obtaining radiants satisfactory from our point of view, Richmonds decided some years ago to undertake the manufacture themselves; and, so far as I am aware, they are the only firm of gas-stove makers who actually carry out this manufacture in their own works. It is desirable that the fuel, which is a very light structure, should possess mechanical strength, and at the same time be capable of resisting the effects of sudden temperature changes to which it is subjected. The tensile strengh of the material is increased by firing, during manufacture, at a high temperature; and this treatment has at the same time the effect of appreciably increasing the thermal conductivity.

Now, it is to be expected that an increase in the tensile strength and in the thermal conductivity will, other things being equal, tend to make the material more capable of withstanding sudden temperature changes without fracture. Unfortunately, when such a material is made, it is found to crack more violently when in use in a fire than a radiant made of the same material but not so hard-fired. It is thus necessary, in the process of manufacture, so to regulate the thermal treatment of the material that the best combined results—that is, from the point of view of the capability of resisting mechanical shocks on the one hand, and the effect of sudden temperature changes when in use in the fire on the other—shall be obtained. By controlling the processes in the works, we have been able to reduce the maintenance of fuel to a low point, and yet to obtain a material of such mechanical strength that our losses in the process of carriage from the works to the gas companies have been reduced to a negligible point.

Results obtained some years ago by subjecting single fuels to test, appeared to indicate that dipping clay radiants into certain solutions prior to their employment in a fire would ensure an increase in efficiency. As the question of radiants is an extremely important one from the gas-stove maker's point of view, we were led to repeat these experiments. Unfortunately, we were unable to obtain the same results, and found that, on taking the radiants out of a given fire, immersing them in a strong solution of copper nitrate (one of the solutions suggested), drying, igniting, and then re-employing them, we did not in any way increase the efficiency of the fire. Before treating the radiants, an efficiency of 51·6 per cent. was obtained, and after treatment an efficiency of 52 per cent. In the earlier work to which I referred, it was claimed that the efficiency of a fire was increased from 43 to 48 per cent. by this treatment.

The material employed in the radiant may affect the radiant heat emitted, owing to its physical properties; but, unfortunately, such a simple treatment as the dipping process mentioned above does not enable us to increase the efficiency of the fire. A particular radiant shown on the screen was designed originally for our "Period" fires; and although we have tried many other makes of fuel, we have not been able to obtain such good results in these fires as with our own radiant. I wish to give you the results of a few of the comparative tests which were carried out some time ago, as the question of the particular radiant to be used with a given gas-fire is of importance, and should not be overlooked by gas engineers when they are considering the question of adopting a standard make of fuel for the various makers' fires which they employ. We endeavour in our fires to obtain as much of our radiant energy as possible directly from the radiant itself; and although we obtain a certain amount of energy from the brick at the back of the fire, we are not so dependent on the energy coming from the brick as appears to be the case in certain other makers' fires. The appended results will, I think, bring this out very clearly:

Table I.—*Effect of Radiant on Fire Efficiency.*

Fire.	Efficiency. Own Fuel. Per Cent.	Another Maker's Fuel. Per Cent.
14-inch P.	54 (No. 10)	50
12-inch P.	52 (No. 10)	47
10-inch A.	45 (No. 12)	41

We next tried a 14-inch fire made by the firm whose fuel was used in the comparative tests given above, both with its own fuel and our No. 10 fuel. In this case, the better result was again obtained with our fuel; but the difference was not so striking as in the above tests:

	No. 10 Fuel.	Own Fuel.
14-inch fire, competitive make	51 per cent.	49 per cent.

Further, the drilling of the burner which is suitable for one particular radiant will not necessarily give equally good results with another radiant which would appear on casual examination to be of similar design. To take a case in point, one of our own make of fires usually provided with the twin-drilling burner is supplied to a certain gas company who have standardized their fuel, with single drillings. The efficiency and results tabulated below show that with the gas company's fuel the efficiency obtained is the same, whether the burner is supplied with the ordinary twin-drilling or with the special single drilling; whereas with our own make of fuel a marked decrease in efficiency results from the replacing of the twin-drilling burner by a burner with this particular single drilling.

Table II.

Fuel.	Burner with Twin Drilling.	Burner with Single Drilling.
Richmond	47·3 per cent.	44·4 per cent.
Gas company's	42·2 ,,	41·9 ,,

In this particular case, if a larger single drilling had been employed, so that when the burner is lit a broader flame is obtained, we should anticipate obtaining the same efficiency with our own fuel with either single or double drilling.

This will serve to emphasize the point which I wish to make—namely, that different fuels in a given make of fire may give very different results. Thus, if an engineer decides to utilize only one pattern of fuel for the various types of fire which he adopts, he may run the risk of materially reducing their efficiency. To avoid this, he should carry out a careful series of tests, to satisfy himself as to which particular make of fuel will give him the best all-round results in the fires he requires; and having arrived at a decision, he should then arrange, if necessary, to modify the burner-drilling and other details of the fire to suit the adopted fuel. Realizing the convenience of one fuel from the gas company's point of view, we ourselves have, while trying to get the best results out of our own particular fires, endeavoured at the same time so to arrange our radiant that it may be capable of giving satisfactory results with many of the better known makes of fires. The results which have been quoted indicate that we have achieved a certain amount of success in this direction.

Radiant Efficiency.

Mr. Hartley then went on to refer to the question of radiant efficiency of gas-fires, giving a table which appeared towards the close of his London lecture. Continuing, he said: No doubt, you are all aware that for each gas-fire there is a consumption at which optimum results are obtainable; and, in the majority of cases, where the gas consumption is increased beyond or decreased below the optimum, a marked fall in radiant efficiency results. Appended are a series of results obtained from one of our 12-inch "R.H.D." fires at varying consumptions (*a*) with highly aërated flames and (*b*) with normally aërated flames.

It will be noticed from these results that, with the normally aërated flames, the efficiency is well maintained over a big range of consumption, but that the falling off in the efficiency of the highly aërated flames with decreasing consumption is quite pronounced, especially at the lower consumptions. Further, that with the highly aërated flame the optimum consumption is probably somewhat greater than with normally aërated flames, and that high aëration gives better results at very high consumptions.

Table III.—"*R.H.D.*" *Fire. Effect of Aëration on Radiant Efficiency at Varying Consumptions.*

Approximate Consumption. Cub. Ft. per Hour.	High Aëration. Per Cent.	Normal Aëration. Per Cent.
18	44·5	48·3
22·5	48·9	50·5
27	49·9	52·7
31·5	53	53·0
36	53·1	51
41·5	51·2	48·7

The radiants employed were designed to take 3¾ cubic feet per hour each on Warrington gas; and with a normal aëration, the optimum consumption is 31½ cubic feet per hour with this fire. When burning 36 cubic feet per hour, flames were seen to come out of the top of the radiants; and at 41 cubic feet per hour, it was obvious that an undue amount of gas was being passed through the fire. On the other hand, with the highly aërated flame, it was not until the consumption was raised to 41 cubic feet per hour that flames began to show above the tops of the radiants. If the fire is going to burn large quantities of gas during the greater portion of its life, then the highly aërated flame will give better results; but if, on the other hand, as more generally happens, the fire is turned down after it has been alight for a quarter of an hour or so, then with this particular fire it is advisable to have a normally aërated flame. By a normally aërated flame I mean a flame just sufficiently aërated to prevent the sooting-up of the radiants.

It has been stated that the efficiency of this "R.H.D." fire was very well maintained over a big range of consumption. That this is better than the average will be shown by comparing the results already given with those enumerated below, which at the same time serve to show that, with a flat-fronted fire, there is

an advantage resulting at low consumptions from this duplex-burner fire, as against its single burner type.

TABLE IV.—*12-Inch Flat-Fronted Fire. Efficiency at Various Consumptions.—Single and Duplex.*

Fire.	Consumption. Cubic Feet per Hour.	Efficiency. Per Cent.
Single-burner fire	31½	48·5
	27	48·4
	22	42·8
	18	40·2
Duplex-burner fire—		
Full on	31½	49·2
Half on	18	44·8

It is admitted that it is desirable to obtain as much radiant heat from the gas-fire as possible, and, if it can be done, to prevent radiant heat being transformed into convected heat before it is admitted into the room. In this manner, a number of small additions can be made to the total radiation by attention to details. [See conclusion of London lecture.]

THE CANOPY.

Some remarks were made by the lecturer which appeared under the heading of "Distribution of Radiant Heat" in his previous lecture; and then he alluded briefly to the bricks at the back of the fires, which he said should be good heat insulators. In order to ensure this, the firm make them as porous as is permissible; the limit to which the porosity can be pushed being determined by the mechanical strength obtainable from the finished article.

Proceeding, he said: The upper portion of the fire—the canopy—is intended to deflect the products of combustion into the coal-fire chimney. When the fire is in actual use, the inward flow of the products of combustion will be ensured in the majority of cases by the aëro-motive force which exists in the chimney. This force is variable in amount, depending both on the movement of the external atmosphere and on the difference of temperature between the gases in the chimney and the outside air. It will be realized that it is impossible to predict the amount of assistance that the fire will receive in this connection when in use. In fact, it is known that in many cases there may be a down-draught operating. In this latter case, it would be impossible to prevent the products of combustion coming into the room; and the remedy is not in the hands of the gas-fire makers.

It will be good, then, if one relies on the assistance of but a small aëro-motive force in the chimney, and, better still, if the canopy is so designed that the products of combustion can be relied on to be passed into the chimney without the aid of any initial chimney pull. In other words, it is desirable so to construct a fire that, when set in the middle of a room, all the products of combustion will pass through the flue-outlet. As you are aware, a test (now known as the "Lancet" test) has been devised for detecting the escape of products of combustion under these conditions.

The test, however, is not applied until the fire has become thoroughly warm—a limitation which assumes that some assistance will be obtained from the chimney. Examination of the conditions in a chimney originally cold, from the moment of lighting-up of a gas-fire, has indicated that undoubtedly an appreciable effect is obtained almost immediately. No doubt, it was owing to some such consideration that, when discussing an examination of the Richmond fires by their hygienic standard, the "Lancet," in their issue of Sept. 12, 1914, after having reported satisfactorily, were led to make the following remarks:

> The test is a very delicate one, as, indeed, it should be, having regard to hygienic requirements. For ourselves, we are inclined to accept that when by the open test a gas-fire shows no leakage with (say) a 2-feet flue attachment (supplied by the makers of the fire), all that is required by hygienic considerations has been done.

The importance of these considerations will be realized when we bear in mind the method sometimes adopted to ensure that the fire shall pass the "Lancet" test. In certain cases the expedient is resorted to of largely increasing the area of the flue-outlet—an expedient which is very simple from the point of view of the gas-fire manufacturer, but unfortunately attended by two distinct disadvantages: (*a*) Larger and more expensive flue-outlets are required in those cases where such attachments are deemed necessary; and (*b*) there results a very marked increase in the volume of air which passes through the flue-outlet as these are increased in size. That an increase results will be recognized when it is remembered that the resistance offered by a thin plate orifice varies inversely as the square of its area.

It is now generally admitted that a high-canopy fire should possess the merit of having its radiant efficiency inappreciably affected by the increased chimney-pull which operates when the fire is in use. This advantage may be nullified, however, if the flue-outlet is enlarged and the flow of air through the canopy of the fire materially increased, as the provision of this increase of volume will involve the flowing of cool air over the heated upper portions of the radiants. Thus I incline to the view that, rather than adopt a large flue-outlet, if it were the only expedient available, for ensuring that the appliance shall pass the open-fire "Lancet" test, I would lessen the stringency of the hygienic standard, and carry out the test with a flue-elbow attachment.

The higher the canopy of a fire, the more difficult does it become to make the appliance pass the "Lancet" test, as it may be impracticable to raise the height of the flue-outlet by the corresponding amount necessary—the flue-outlets having in the majority of cases to pass underneath an existing coal-grate canopy. On the other hand, it is to be remembered at the same time that the higher the canopy of the fire the larger can the flue-outlet be made while still ensuring that the radiant efficiency is not appreciably affected by the operation of chimney-pull.

If the adoption of the hygienic standard which we have discussed previously had involved the employment of a low overhanging canopy with fires, it is doubtful whether it would ever have become the universal standard. The case for the adoption of this standard appeared to me to be indisputable when we were able to show that, by proper canopy construction, high-canopy fires could be made fume-proof.

Some considerations bearing on the designs of canopy were given in my Yorkshire Junior Association lecture in 1913; and our ledge principle of canopy construction, which has since been adopted by other makers, was discussed. This principle renders one independent, within wide limitations, of the actual contour of the canopy of the fire-casting, and in the case of double canopied fires enables a common back to be employed for a variety of designs of castings.

VENTILATION.

Finally, Mr. Hartley dealt with the important question of ventilation, on very similar lines to his London and Southern Junior Association lecture—showing by the aid of the lantern several of the curves which were at that time reproduced in the "JOURNAL." This portion of his lecture he summed up by saying that the practical points worthy of note in connection with gas-fire ventilation are as follows:

(*a*)—As large an inlet as practicable to the well at the bottom of the chimney should be provided.

(*b*)—The most important factor is the total area of flue and subsidiary inlets. The relation between the area of the flue and that of the subsidiary openings is of only minor importance, viewed solely from the point of the volume of air moved. But it must be borne in mind that excessively large flue-outlets may reduce the radiant efficiency of the fire. It must also be remembered that, as the size of the flue is increased, the difference between its ventilating power and that of a subsidiary opening of equal area gets smaller.

(*c*)—When the effective resistance of the inlets to the chimney is equal to that of the chimney shaft, at least 80 per cent. of the ventilation possible with the thermal energy available is obtained; and if the inlet area be increased beyond this point, little advantage will accrue.

DISCUSSION.

The PRESIDENT (Mr. J. J. Scott, of Lower Larbert) said they were indebted to Mr. Hartley for his lecture. When they fitted up gas-fires, coupled-up the gas connection, applied a match, and said "There is your fire," possibly they little thought of the amount of scientific work that had been expended to provide these things. The lecturer had demonstrated upon how many little points the efficiency of the gas-fire depended. It was difficult to grasp at once all the details.

Mr. J. B. SCOTT (Cowdenbeath) declared that the members had received a few "tips" which would come in useful. They did not fully recognize the value of such experts as Mr. Hartley in bringing the gas-fire to its present perfection. One scarcely noticed the difference between gas-cooker business and gas-fire business. Gas-cookers seemed to have reached a standard, so that there was not much difference between a new one and one ten years old. The old one was pretty good, even to-day But the gas-fire of last year was almost ready to scrap this year, there was such an improvement. There would be, however, an end to this some day, because even scientific research was bound to come to a point when it could not go on developing at such a rate as gas-fires had been developing of recent years. A great trouble for gas engineers was connected with this point, because where fires were hired-out, people wanted them changed before they had earned their cost. He hoped the time would come when gas-fires would be good for eight or ten years. He asked whether Mr. Hartley advised, where the grate-opening had been built-up and tiled, that an open space should be left in the building-up all the way down behind to the bottom of the fire, and all the way back to the back of the hearth.

Mr. HARTLEY replied that there was only one point to consider there, and that was the danger of dirt falling down the chimney, and people not being able to get it out. This hole was necessary for ventilation; and there was no use for a hole in the casting, if it was blocked-up behind. There would need to be an ample hole in the well of the chimney. If stuff fell down the chimney it could not come out if the gas-fire were properly fitted. In regard to gas-cookers, he said the old ones were as good as the new, so far as the hot-plates were concerned; but there was room for improvement there. In the oven there was not much scope for improvement. It was a question of first cost. So little gas was burned that it might not repay a further expenditure, even of a few pounds, in improving the hot-plate. As to gas-fires, the day would come when there would not be such great changes. Nothing new had been brought out this year. In future, they would be concerned more or less with details. There would always be variation in the designs of castings. He was not sure that the trouble about fires getting out-of-date was not due to the fact that ideas in regard to castings had varied.

Mr. ROBERT AIR (Crossgate) pointed out that flue-pipes were

mostly 8, 9, and 10 inches broad, and 3 inches wide. He asked whether, by using them, any real harm was caused to the radiant efficiency.

Mr. HARTLEY replied in the negative; but said this would be up-against hygiene.

Mr. AIR asked if the moveable canopy in ordinary grates must be opened for the "R.H.D." fire.

Mr. HARTLEY said it would depend on the type of the canopy. Some coal-grates were blocked-up altogether. There must be an opening; but it was immaterial whether it was back or forward. Discretion had to be used.

A hearty vote of thanks was accorded the lecturer.

THE DETERIORATION OF LEATHER USED IN GAS-METERS.

By M. C. LAMB, of the Leathersellers' Technical College, Tower Bridge Road, S.E.

[An Article communicated to the "Journal of the Society of Chemical Industry."]

In the early part of 1913 the author was consulted by the South Metropolitan Gas Company, and at their request commenced a somewhat elaborate and lengthy investigation with the view to elucidate the cause or causes which were responsible for the rapid deterioration of the leather employed in the construction of gas-meters.

The author now places on record the results of this investigation, so far as it has progressed, as a contribution to the general discussion on the important subject of the "Life of Gas-Meters." A preliminary report of a Joint Committee appointed by the Institution of Gas Engineers and the Society of British Gas Industries has recently been published.*

As is well known to gas engineers, there has, of recent years, been a gradually increasing tendency on the part of gas-meters to require repairing on account of either partial or complete breakdown of the mechanism of the diaphragm used as a measuring instrument for the amount of gas passing—thus interfering with the correct recording of the quantity of gas consumed.

The major portion of the complaints were apparently traceable to the leather used, either in the form of a complete diaphragm, or perhaps more generally used to form the connecting bellows of two diaphragms made of tin plate; the leather having apparently undergone some form of deterioration, thereby losing its necessary property of providing a gas-tight medium.

METER LEATHER REQUIREMENTS.

The hitherto recognized requirements of the meter manufacturer, as understood by the three or four firms of leather manufacturers specializing in the manufacture of meter leathers may be summarized as follows:

(1) The leather, with one exception, that general usage has demanded has been the so-called Persian sheepskin—a native-tanned East India sheepskin. The selection of this particular class of skin was no doubt due to the fact that this leather, on account of its close texture and compact fibre structure, was less liable to porosity, and hence was considered more suitable for the purpose than domestic sheepskins, which possess a more open texture and porous character, and are naturally greasy.

(2) The leather, when dressed, must be supple, free from excessive natural fat, and free from stretch. It is a necessary stipulation that the skins should be specially selected for freedom from holes.

(3) The substance of the leather is to a great extent determined by the size of the diaphragm upon which it is intended to be used—thin substance skins, *e.g.*, 0·4 to 0·5 mm. for five-light meters, to from 1 to 1·5 mm. for the larger sizes.

(4) In the majority of cases the meter manufacturer stipulates that the grain of the leather should be removed by buffing; the object of this apparently being to make it softer, and to increase its power of absorbing the oil and graphite mixture used as a finishing dressing. The buffing produces a surface which is capable of retaining a greater proportion of the dressing than is the case when the grain has not been so removed.

(5) The exception (1) mentioned above, so far as the author is aware, only refers to one particular meter manufacturer in Great Britain, and is therefore in the nature of an individual experiment. The leather used is a split sheepskin of British tannage, known as a skiver—*i.e.*, the grain side of a sheepskin. It is of thin substance, has little tensile strength, and is liable, unless extreme care is taken in the selection, to be entirely unsuitable on account of its tendency to possess natural perforations, known as "pinholes," due to the natural growth of the skin. It has been stated to be satisfactory in use; but, in the author's opinion, it is not suitable for general adoption on account of its somewhat irregular physical character and its low tensile strength, though the latter factor does not play so important a part as one might anticipate without a full knowledge of the internal working of the meter leather when in use, and its method of attachment. The fact of its employment is interesting, however, as showing that, with the one exception, every British meter manufacturer has adhered to the use of the "E.I." sheepskin; and though this was not considered satisfactory, particularly during recent years, apparently no other kind of leather has been tested with the object of finding a better substitute, or the experiments have resulted in failure.

* See "JOURNAL," Vol. CXXXIV., p. 586.

GENERAL INVESTIGATION OF CAUSES OF DETERIORATION.

The investigations of the author were in the first place directed to the leathers employed and their condition after being in use for varying periods, as ascertained by examining the leather and diaphragms removed from a very considerable number of meters of many makes, returned to the repair shop of the South Metropolitan Gas Company.

This examination revealed the fact that in almost every instance the perforation of the meter leather was, in the majority of cases examined, in a line drawn parallel to the periphery of the metallic diaphragm to which the leather was attached; the extent of the perforation varying from ¼ inch to, in a great many cases, 5 or 6 inches. The leather, on examination, after having been freed from the remains of the graphite and oil dressing, while being sound and unaffected in the centre of the leather strip, was hard and perished where it had come in direct contact with either the metallic band fastening the leather to the diaphragm, or with the diaphragm itself. In every case examined, the leather where it had perished and become hard was also discoloured, and was in the majority of cases practically black. In one or two instances a narrow strip of leather had been placed in direct contact with the metal diaphragm, and under the meter leather, to act as a cushion when the meter leather was fixed by hemp cord or string. The strip of leather which was protected from direct contact with the gas had, in every case examined, completely perished.

Subsequent analytical investigations showed that at the points mentioned the deterioration of the leather had undoubtedly been caused by iron, which had converted the tannin into a tannate of iron. This, by continuous oxidation and reduction, made the leather hard and caused it to disintegrate and perish. The amount of iron found was in some examples as great as 0·3 per cent. (Fe).

METHODS OF ATTACHING DIAPHRAGMS.

Attention was next paid to the various methods of attaching the leather to the diaphragms as adopted by the various makers. These consisted of either (*a*) attachment by means of steel bands, most commonly covered to protect the band, either with linen tape or leather; or (*b*) attachment with several coils of hemp cord drawn tightly round the edge of the metal diaphragm, a cushion being made of a thin strip of leather as stated above, to produce a tight joint.

In the few cases examined where the metal band was covered with leather, it was found that the leather in contact with the metal band had also entirely perished and become black and brittle.

The author ascertained that some manufacturers, with a view to the production of a tight joint, used various adhesives to embed the leather when the band was tightened-up, so as to close-up and make gas-tight any small crevices or openings that might otherwise result. A number of these were examined—*e.g.*, flour paste, mixtures of resin and tallow, paraffin wax and tallow, and buck tallow. A sample of flour paste examined was found to contain an appreciable percentage of alum. Such a mixture must be unhesitatingly condemned, as owing to the free sulphuric acid liberated, it dissolves the metallic band, and thereby hastens the deterioration of the leather by transference of the resulting iron salt to the leather.

A mixture of ordinary tallow having, as is usual, a high "acid value," due to the condition of rancidity, must also be condemned for the purpose. Mixtures containing resin are also unsuitable. The most suitable materials for the purpose, in the opinion of the author, if it is considered necessary to embed the leather in this way, are paraffin wax, rendered sufficiently plastic by mixing with a small quantity of vaseline, or else pure buck tallow, which must not possess a high acid value.

One of the earliest changes made in the repair shop of the South Metropolitan Gas Company, and which has since been retained after some three years' experience, was the substitution of an aluminium band for the steel band attachment. The employment of an embedding agent has been discontinued, as being unnecessary when the fitting was carefully performed.

It is of the utmost importance that the leather should be quite dry before it is fixed to the meter, and the stock of leather should be stored in a dry atmosphere. Otherwise the moisture in the leather will quickly cause pitting of the tinned surface of the metal diaphragm at the points of contact with the leather, with consequent exposure of the iron surface.

OIL USED IN DRESSING.

Samples of the oil used by meter manufacturers for mixing with graphite to produce a leather dressing were examined. Almond oil has long been employed for this purpose and has peculiarly suitable properties.

The oil used for the manufacture of the dressing should be a non-volatile, non-drying oil, and must remain liquid at low temperatures. It must also be an oil which does not become rancid, and has a low "acid value." Almond oil possesses all these properties. Other suitable oils fulfilling the necessary qualifications are peach kernel oil and apricot kernel oil. These are often used to adulterate almond oil—being cheaper; but for the purpose

under review they are just as suitable. Sulphonated oils are quite unsuitable, either for use in the making of the graphite dressing or in the treatment of the leather.

It has been stated that manufacturers of meters in the United States do not employ any oil dressing in the leathers used. The advantage of the dressing as a protective covering against any injurious chemical impurities of the gas is obvious if reasonable care is taken that the oil used is the most suitable obtainable. The graphite acts as a filling agent, closing-up the interstices of the fibres, and tends to produce a more perfect gas-tight medium. The use of petroleum jelly (vaseline) to replace almond oil has not been adopted; but it appears to the author to possess some advantages that render it particularly suitable.

Experiments with Meter Liquids.

Several samples of the liquid condensate from several gas-meters were examined. A number of samples were found to contain small amounts of ammonia and ammonium salts, compounds of cyanogen, and a fairly high percentage of inorganic non-volatile salts was found, and salts of iron and tin were present in comparatively large amounts. To ascertain the effect of the condensates on meter leathers, some samples of different leathers were immersed in samples of liquids removed from meters in which the original leathers had been adversely affected. The results obtained were of a negative character; in every case the condensate had no appreciable effect when used as above, though the experiments were prolonged for more than six months.

An interesting experiment, which threw some light on the causes of deterioration, consisted of binding strips of leather round pieces of the metallic band used for attaching the meter leather to the diaphragm, and immersing these in meter liquids. The leather in every case, whether the steel band was protected or not with linen strips, was deteriorated and rendered brittle. The deterioration at the parts in contact with the metal was most pronounced, but also extended, but to a less degree, to the portions which were not in direct contact.

This experiment confirms to an appreciable extent the deduction formed on examination of a large number of leathers that had been removed from meters and which had probably perished, as mentioned above, owing to the corrosive action of the acid and ammonia constituents of the gas on the metal band.

New Leathers for Gas-Meters.

Experiments were made with several leathers of different tannage to those ordinarily employed as mentioned above. Leathers of vegetable tannage are particularly susceptible to deterioration by the action of acid fumes and of alkaline gases; leathers tanned with mineral tannage agents are not so injuriously affected. In the light of this fact, meter leathers were prepared of chrome tannage, also alum tannage, and semi-chrome tannage, which latter consisted of a vegetable tanned East India (Persian) sheepskin from which the greater portion of the original vegetable tannage had been removed by treatment with weak alkaline salts, and replaced by retanning with basic chromium sulphate or chloride.

Leathers of these three different tannages were placed in meters; and to obtain a result as quickly as possible, several meters were fixed in various parts of the South Metropolitan Gas-Works, where they were continuously in service. Some few meters fitted with the experimental leathers were also placed on the ordinary circuit. At varying periods some of the meters were disconnected and the contents examined.

Alum Tanned Leather.—The alum-tanned leather underwent considerable deterioration, and after a short period became hard and possessed the appearance of being undertanned, probably owing to the action of the ammoniacal gases. Previous experiments, made by immersing the leather for a lengthy period in meter liquids, had indicated the unsuitability of the leather; the meter liquid possessing a solvent action upon the tannage.

Crome Tanned Leather.—On the other hand, it was found that the sample of chrome tanned leather was quite unaffected; remaining soft and supple, and apparently in as good a condition as when first enclosed in the meter.

Semi-Chrome Leather.—The behaviour of a well-chromed semi-chrome leather, so far as could be ascertained by the somewhat severe tests to which the samples of leather were subjected, was equally encouraging as the fully chrome tanned leather. Samples removed from the test meters after two years' trial showed no signs of deterioration whatever.

Samples of both the chrome and semi-chrome leathers were analyzed before and after the experiment. The results of the chemical tests showed practically no change in the leather:

—	Chrome Leather.		Semi-Chrome Leather.	
	Before.	After.	Before.	After.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Mineral ash	5·7	5·9	3·25	3·30
Chromic oxide	3·0	3·0	2·10	2·15

The following tensile strength tests were made:

Chrome Leather.		Semi-Chrome Leather.	
[Mean of four tests of strips ½ inch wide by 2 inches long.]			
Before Treatment.	After.	Before.	After.
21·4	20·7 ..	21·0	21·5

A careful comparative microscopical examination of sections of each of the leathers showed that the samples had undergone no deterioration of the leather fibres.

In view of the fact that the experiments had shown, so far as could be ascertained in the limited time over which the tests had been made, that the semi-chrome East India tanned leather was undoubtedly superior to the ordinary East India (Persian) in general use, it was decided to adopt this leather provisionally for general repair work and in the manufacture of meters constructed by the South Metropolitan Gas Company.

The following specification was eventually adopted with a view to obtaining from various contractors a leather that contained a sufficient chrome content to ensure that the leather had been properly retanned with the basic chromic salt, and having in view the most suitable treatment for the purpose of providing a leather that the experiments indicated to be the most promising.

Specification for the Supply of Leather Intended for Use in Gas-Meters.

Semi-Chrome East India (Persian) Sheep.

Material.

1.—The skins are to be dressed from a good quality East Indian tanned Persian sheepskin of naturally "dry" tannage.

2.—The goods to be selected of as near as possible the requisite substance in the crust condition, in order to avoid the necessity of materially reducing the substance by shaving all over the skin.

3.—The goods to be reasonably free from grain defects and "tick," and from flaying defects. The skins to be free from holes.

Dressing.

1.—The skins to be prepared by lightly stripping with borax, washing, and retanning with basic chromium sulphate or basic chromium chloride in sufficient quantity to give the required chromium content given below (2).

2.—The leather to contain 2 to 2·5 per cent. of chromic oxide on the dry weight of finished leather.

3.—The leather to be neutralized after retanning.

4.—The fat-liquoring to be done with neatsfoot oil and neutral soda soap, using an amount equivalent to 3 per cent oil and 2 per cent. soap on the dry finished leather.

5.—The leather to be staked, fluffed, and lightly buffed on the grain side, except when expressly stipulated that buffing is not to be done.

6.—The goods to be soft full supple leather, and free from any inclination to hardness.

One of the advantages in favour of the adoption of this leather was that it could be supplied by any firm of leather dressers ordinarily engaged in the dressing and finishing of East India tannages. Subsequent experience has inclined towards the adoption of real chrome leather made from a domestic or New Zealand lamb skin for use upon the smaller sizes of meters, but retaining the semi-chrome tanned East India sheep for larger sized meters. Real chrome leather in the majority of cases was found to be too soft and inclined to bagginess when employed upon large sized meters—a defect which is conducive to incorrect registration. Semi-chrome "E.I." sheep of 1 to 2 mm. thickness possesses, when properly dressed, the right amount of suppleness without any inclination to be so soft as to be liable to sag when used as the bellows of the meter.

The specification which has been provisionally adopted for real chrome lamb leather is as follows:

Chrome Leather.

Material.

1.—The skins to be tanned from a domestic lamb-skin or New Zealand pickled lamb pelt of good quality, of 6 to 8 square feet area.

2.—The goods to be specially selected for freedom from cockle, and be reasonably free from butcher cuts, holes, and other defects.

3.—The skins to be selected of as near as possible the required substance, in order to avoid the necessity of shaving.

Tannage and Dressing.

1.—The goods to be tanned by the chrome process, and to contain a minimum of 3 per cent. of chromic oxide, calculated on the dry (degreased) finished leather.

2.—The goods after tanning to be neutralized and afterwards fat-liquored with a minimum of 2 per cent. neatsfoot oil and 1 per cent. soda soap on the dry finished leather weight.

3.—No glycerine or other substance of a hygroscopic nature to be applied to the goods.

4.—The goods to be staked, strained, and fluffed on the flesh side, and delivered in the original undyed blue colour.

5.—The skins to be supple, fully tanned, well nourished leather, and to be free from any tendency to hardness.

It is extremely satisfactory to report that since the adoption of the semi-chrome leather for use upon all meters of the South Metropolitan Gas Company (and which change was made on the author's suggestion as far back as July, 1913), not one meter fitted with these leathers has been received by the repair shop for renewal of the leather, and in all the numerous cases which have been examined, including the original experiment and tests made on meters in continuous service, no deterioration of the leather has been observable.

While the author does not claim that the substitution of the two leathers above referred to is the final answer to the question under discussion, the practical result shows that the adoption is at any rate one step in the right direction.

The resistance of chrome leather (and of leather semi-chromed to such a degree that it possesses practically the whole of the

essential properties of the full chrome product) to the action of small traces of acid, and of alkaline gases, was thoroughly investigated by the author some years ago,* in continuation of the investigations of the special Society of Arts Committee on the Deterioration of Leathers for Book Binding, published in 1901. It is also now a well-known fact that the life of chrome tanned belting leathers used for the transmission of power in chemical and other works, where they are subjected to various chemical gases, is much greater than is the case with ordinary vegetable tanned leather, and also longer than is the case of the majority of cotton and other fibre belts.

In the recent report made by Dr. Lessing to the Joint Committee representing the Society of British Gas Industries and the Institution of Gas Engineers, reference has been made to the investigations of the Society of Arts Committee on the Deterioration of Book Binding Leathers, referred to above. Dr. Lessing gives details of analyses of 21 samples of leathers used for meter diaphragms in which the percentage of acid (in terms of sulphuric acid) varied from 0·54 to 1·37 per cent. in leathers that had not been used. These results are entirely contradictory to the author's experience.

As above referred to, the ordinary meter leathers are made from sheepskins tanned in East India, chiefly by native tanners in a comparatively small way of business. The term Persian applied to these goods does not indicate the source of origin, and is only a trade description that originated many years ago, when an importer having discovered these goods in India was desirous of eliminating competition for their purchase; and in order to mislead his trade rivals he called them Persian sheepskins, which resulted in keeping the source of supply secret for some time. The original route for the East Indian shipping was by way of the Persian Gulf. No mineral acid is used by the native tanner in the manufacture of these goods; and in a lengthy experience of these goods the author has not known a single case where the leather has been found to contain sulphuric or other mineral acid in the original condition as imported.

The author can also vouch for the fact that the three principal leather manufacturers specializing in the manufacture of leather for meter diaphragms do not use sulphuric acid in the dressing of these particular goods. The use of sulphuric acid for clearing and improving the ground colour of East Indian and other tannages preparatory to dyeing bright and fancy shades of colour was quite common before the investigation of the Society of Arts Committee, and resulted in the rapid deterioration of these leathers when used for book binding. This practice has now ceased upon these leathers, following the report in question. It has never been common in the case of meter leathers.

With reference to the statement made in Dr. Lessing's report, that the presence of decomposition products of leather was found in the non-volatile residues obtained from meter liquids (from which he infers that there has been solvent action of the gas and meter liquids on the leather diaphragm), the author would point out that some small amount of leather substance is invariably present in all meter liquids. This does not necessarily originate by reason of any solvent action of the gases or the meter liquid, but is often due to the fact that the leather, on account of its having been subjected to mechanical attrition on both sides on an emery wheel, has a fine velvety nap surface, and if not carefully brushed before being cut up, introduces a quantity of leather dust into the meter which subsequently finds its way into the meter liquid. The samples of meter liquids examined by the author have had, as above stated, little solvent action upon pieces of leather that have been immersed in them for long periods.

The above results of the investigation are not considered by the author to be final, but, as stated in the opening paragraph, to be a contribution to the discussion of the subject. Further experimental work is in progress; and the author hopes to be able to communicate in due course any interesting results dealing with this important industrial problem.

* "Journal of the Society of Dyers and Colorists." Vol. XXIV., 1908, p. 160.

British Oil Supplies.—Speaking, at the Royal Society of Arts, on the subject of British oil supplies, Dr. William Forbes-Leslie declared that investigation had revealed the presence in Norfolk of an oil-shale series of very considerable importance. On a test from a ton of shale, 40 gallons of oil had been obtained, 66 lbs. of sulphate of ammonia, and 25,000 cubic feet of dry gas of high illuminating properties. There was little doubt that a large oil-shale basin existed in Norfolk. England was, he added, not so entirely destitute of oil resources as many people supposed. In the near future the oil fields of the Kimmeridge outcrop might be supplying much of the oil and petrol consumed in this country.

Department of Commercial Intelligence.—With a view to improving the organization for assisting British trade by collecting and disseminating commercial information, the President of the Board of Trade has decided to amalgamate the Commercial Intelligence Branch and the Exhibitions Branch of the Board, and has appointed Sir William Clark, K.C.S.I., C.M.G., to be Comptroller-General of the combined Department, which will be known as the "Department of Commercial Intelligence." Mr. Thomas Worthington, who has just retired from the post of Director of the Commercial Intelligence Branch under the age limit, has consented, at the request of the President, to assist the Department in a consultative capacity as Commercial Adviser.

THE AMERICAN GAS INSTITUTE COMMITTEE ON CAST-IRON PIPE-JOINTS.

At the meeting last week of the American Gas Institute, the Committee on Cast-Iron Pipe Joints, presented a "report of progress," which, in the introduction covered briefly the history and scope of the work accomplished up to the session of the Institute last year at San Francisco—largely consisting of definite specifications [see "JOURNAL," Jan. 4, 1916, p. 31] for the making of cement joints, and which have already been adopted in whole or in part by a number of gas companies.

Two slight additions to the specifications were suggested: 1. The joints must be "home"—*i.e.*, iron to iron. 2. Joints must not be "broken"—*i.e.*, the pipe must not be laid out of line more than 5 inches in each 12-foot length.

Comments were made on the discussions submitted on the previous report—particularly to the discussion by Mr. Evans covering his interesting experimental work on large joints. It was pointed out (with data) that the experiments that resulted in the condemnation of large cement joints were not necessarily conclusive.

A brief report of the work of the Committee during the year described experiments under way to endeavour to determine the actual strength of cement joints. It also points out that from the data collected, and the inconclusive results obtained so far in laboratory work, it would be unwise to attempt to submit a final report at this time.

The proposed continued work of a Committee on Cast-Iron Pipe-Joints is then outlined:

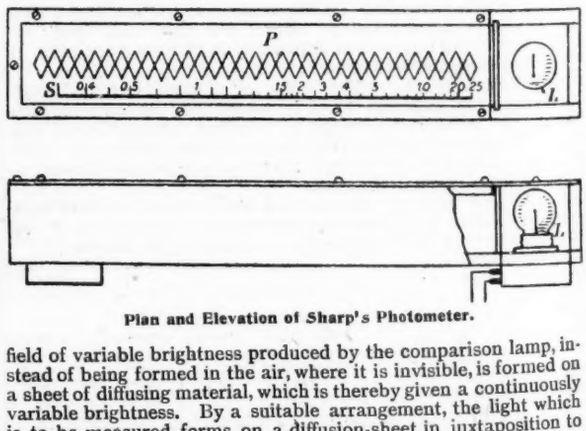
1. That the investigation of the cement joint be continued with the idea of ultimately producing a satisfactory cement joint for large mains.
2. That specifications similar to those for cement joints be prepared for cast-lead and combination joints.
3. That all the special forms of cast-iron pipe-joints be investigated and described, with such comments as may seem necessary, in view of the very limited use of these joints in America.
4. A clamp to go over the standard bell-and-spigot pipe should be designed.
5. Recommendations should be made as to the type of joints for cast-iron pipe under pressures higher than the usual low pressure.

The final recommendations were that a Committee be appointed to continue the work following the outline, together with such modifications as may be brought out by the discussion or recommended by the Technical Committee.

A SIMPLE PORTABLE PHOTOMETER.

Described as the invention of an American, Mr. Clayton H. Sharp, the "Engineer" recently gave particulars and an illustration [reproduced] of an instrument that "involves what is believed to be a new principle in photometry."

Our contemporary remarks: In the ordinary photometer the comparison lamp produces in space a field of flux-density which varies inversely as the square of the distance from the lamp; and a photometric device is moved longitudinally through this field until a point is found where the flux-density of the field is equal to the flux-density of the light to be measured, which impinges on the other side of the photometric device. In the new instrument the



Plan and Elevation of Sharp's Photometer.

field of variable brightness produced by the comparison lamp, instead of being formed in the air, where it is invisible, is formed on a sheet of diffusing material, which is thereby given a continuously variable brightness. By a suitable arrangement, the light which is to be measured forms on a diffusion-sheet in juxtaposition to this field; so that the point can be readily seen where the brightness of one field equals that of the other.

The apparatus (as shown) consists of a rectangular box about 1 inch in cross section and 8 inches long, containing at one end a small tungsten filament lamp L, behind an opal glass screen. The

top of the box over the rest of its length is made up of a sheet of clear glass to which is pasted an arrangement of papers P, which constitutes what may be described as a continuous photometer disc of the Leeson type, extending from one end of the glass to the other. The interior of the box is painted white, except at the far-distant end, which is black. The photometric element P consists of a sheet of fairly heavy paper with a slit cut out of it, having saw-tooth edges. Over the entire arrangement is pasted a sheet of thinner translucent paper having a matt upper surface.

When the lamp is lighted, the end of the slit nearest the opal glass is seen to be very bright; and this brightness fades away gradually towards the other end of the slit. When an exterior illumination falls on the photometric device, the outer portions are illuminated almost wholly by the exterior illumination, while the slit is illuminated chiefly by the light from the inside of the box. At the point where the brightness of the exterior portion corresponds to the brightness of the slit, the saw-teeth fade away, and are hard to distinguish. This point can be recognized without difficulty, provided the papers are properly selected for the purpose; and it indicates the photometric value on the scale S. The error of reading may be given as roughly of the order of $\pm$ 5 per cent.

A calibration is carried out by using a standard lamp, and marking at different known illuminations the points of photometric balance, whereby a scale may be drawn. The incandescent lamp must be well seasoned, and must be held at a constant voltage or constant current by means of an instrument suitable for the purpose. Inasmuch as 1 per cent. change in current causes approximately 10 per cent. change in the candle-power of the lamp, a really good instrument is required.

In the complete apparatus the photometric box is mounted on a larger box which contains a single dry-cell serving as the source of current. The box also carries a small precision voltmeter and a rheostat. The photometric box is so arranged that it can be removed from the rest of the apparatus; the cord with which it is connected being stowed away in the larger box when the two are used as a unit. Photometric readings are taken in a direction at right angles to the axis of the box.

EXTENDED USE OF DIFFERENTIAL PRICES FOR GAS IN THE UNITED STATES.

We recently had occasion to notice differential price schedules for gas as introduced in Chicago and Baltimore, and now observe that the Public Service Commission for the State of Indiana have approved several similar schedules in various districts within their jurisdiction. The Interstate Public Service Company are adopting a new schedule in the City of Seymour that represents a reduction of price to large consumers, to take effect on and after Sept. 1, on the following basis:

Minimum charge per month. . . .			$0·50	
For the first	5,000	cubic feet per month,	1·10	per 1000 cubic feet.
,, next	5,000	,, ,,	1·00	,, ,,
,, ,,	15,000	,, ,,	0·90	,, ,,
,, ,,	25,000	,, ,,	0·80	,, ,,
,, ,,	25,000	,, ,,	0·70	,, ,,
All in excess of	75,000	,, ,,	0·60	,, ,,

A discount of 5 c. per 1000 cubic feet is allowed for prompt payment.

The Peru Gas Company have also adopted a new schedule, in place of a flat-rate of $1 per 1000 cubic feet irrespective of the quantity of gas consumed, to come into operation on Oct. 1. After this date the charges will be:

First	10,000	cubic feet per month,	$ 1·00	per 1000 cubic feet.
Next	20,000	,, ,,	0·90	,, ,,
,,	20,000	,, ,,	0·80	,, ,,
All over	50,000	,, ,,	0·70	,, ,,

The Vernon Natural Gas and Oil Company are introducing a new rate schedule for natural gas. Formerly the charge was 35 c. per 1000 cubic feet, irrespective of the quantity consumed, less a discount of 5 c. per 1000 cubic feet for prompt payment. The new prices are calculated to encourage large users, and are as follows, exclusive of the cash discount, which is retained:

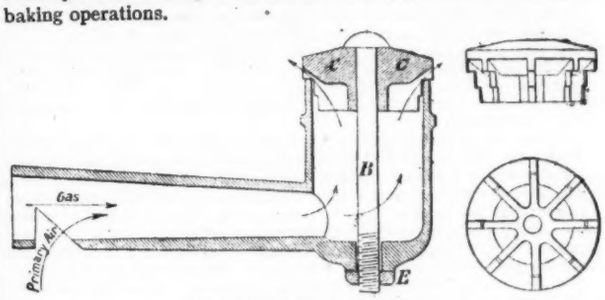
First	25,000	cubic feet per month,	35 c.	per 1000 cubic feet.
Next	25,000	,, ,,	30	,, ,,
All over	50,000	,, ,,	25	,, ,,

The subject was considered in full detail in a paper submitted by Mr. J. M. Spitzglass at the meeting of the Pacific Coast Gas Association held in September. He traced the development from the origin of differential prices to the present time, and recommended that as a general rule, whether differential rates were in immediate view or otherwise, the accounts of all gas undertakings should be so kept as to show the actual cost of each consumer, which enabled the working expenses on each class to be determined—which was supplied at a loss, and which brought in a profit. The number of consumers and the consumption by each class should be known, also the prospective or maximum capacity for consumption, as ascertained by all electricity companies, and which was no less important than the record of the actual consumption. The books should show the cost of each customer per month, and the full delivering capacity of his service pipe, as well as the actual consumption.

The custom of recording expenses at so much per 1000 cubic feet of gas made or sold might as well be abolished, because there was no relation between the cost per consumer and the quantity of gas consumed. The expenses must be allocated where they rightly belong before it was possible to apply them as a basis for practical rate making. There should be co-operation in this matter between different gas undertakings, and a central bureau should be established which would serve as a clearing house for differential rates.

A BURNER FOR GAS COOKING.

In their issue for Oct. 5, the "Journal des Usines à Gaz" gave a description of a type of gas-burner, stated to be that of M. Guénot, which was recently installed in batteries of various sizes by M. Simon, a pork butcher, of Paris, for both boiling and baking operations.



Guénot's Cooking Burner.

The unit burner, as shown in the illustrations, consists of a horizontal chamber to which the gas and air are admitted. These pass together into a vertical cup, in the upper orifice of which is the head C, mounted on the stem B, and adjusted by the thread E in the base of the cup. The head C is shown in further detail in the two small drawings.

Burners of this pattern are grouped together in a bunch of six or seven, provided with a central bye-pass flame. An installation, embodying altogether eighteen of these burners and of great capacity for both boiling and baking, is illustrated, and a comparison made as regards economy between it and the wood fuel previously employed. The total cost with the latter in the course of a year was 1940 frs., nearly half of which was for manual labour. With gas, the cost was 1460 frs., representing a net saving of 480 frs. The gas installation, moreover, has been found greatly superior in the evenness, uniformity, and suitable control of the heat and in the clean condition of the work-room. Also, with gas heating, one oven can be used for different purposes and, by the application of the recuperative principle, the output of certain goods made by pork-butchers is as much as doubled.

MEASURING THE FLOW OF UNPURIFIED GASES AT HIGH TEMPERATURES.

Among the papers to be presented at last week's meeting of the American Gas Institute was one on the above subject, by Mr. J. M. Spitzglass—so far only available in abstract form.

The object of the paper was to bring forward some experimental work that has been done on the measurement of unpurified gases at high temperatures—more especially to measure the gas product at the outlet of water-gas generators. This measurement is, says the author, very important in plants where more than one set is operated, and would also be of value in plants where only one set is operated at a time, because it enables the gas maker to observe the performance of the machine during the various parts of each run.

Experiments conducted at the Pitney Court station of the Peoples Gaslight Company of Chicago on measuring the volume of gases flowing from each individual generator were described in detail. The device employed consisted of a special Pitot tube and differential gauge, adapted after a series of experiments were performed on various other types or tubes. Trials were made to measure the gases at the outlet of the superheater, before they enter the wash-box. It was found, however, that the measurement of the gases at the outlet of the wash-box is more convenient, and offers better control on the operation of the machine.

Sketches were given of the various tubes used in the experiments, and a number of diagrams demonstrated the advantages of measuring the flow from each machine individually.

The difficulties of determining the flow of saturated gases at higher temperatures necessitated the preparation of a series of tables giving the properties of gases at various specific gravities. Eleven tables of this kind were attached to the paper; and examples were given showing the application of the tables in determining the flow of saturated gases. It was hoped, said the author, that with the aid of the tables, and the given outline of the work, the measurement of saturated gases at higher temperatures would be much simplified and would be applied more conveniently for the efficient operation of gas-works.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Low-Temperature Carbonization.

SIR,—My attention has been called to the reference in this week's "JOURNAL" (p. 119) to the remarks on low-temperature carbonization made by Mr. Wallace Thorneycroft at a meeting of the Institution of Mining Engineers. Coming from such an authority, such remarks would carry weight; so that I feel it incumbent on me to traverse the same.

First Mr. Thorneycroft states that low-temperature coke is "char," very friable and porous, and prone to readily absorb water. I do not know whether the speaker ever handled really well-made low-temperature coke. Certainly, if he had done so, he would never have designated it "char." Well-made low-temperature coke, as I know it, is made under very great compression, such as can never be attained in a gas-works retort, be it either horizontal, inclined, or vertical. This super-compression would assuredly prevent the evolution of gas at such a low temperature as 1000° to 1200° Fahr., were it not for the high vacuum—over 20 inches of mercury—to which the coal in process of carbonization is subjected, so that complete carbonization is effected in four hours or so.

I recollect attending some experiments made by Dr. Bueb, at Dessau, where the doctor was endeavouring to produce a dense foundry coke by gas-works processes, and a rectangular retort was packed by a machine as tightly as possible. The coke produced was certainly very dense; but the time of carbonization, even at 2000° Fahr., exceeded 30 hours, and the resultant gases were worthless. Dr. Bueb would probably have succeeded in carbonizing within six hours, and produced a good gas, had he been able to employ a high vacuum on his retort. But he did not know at the time of the efficacy of a high vacuum; neither was his retort (a fire-clay retort) suitable for working under a high vacuum.

It is by carbonizing in thin vertical layers—3½ inches to 4 inches thick—in a constricted space, under high vacuum, that low-temperature coke can be produced of good density, and which will easily bear transport. If you tried to make low-temperature coke by allowing the coal to lie loosely in the retort, free to expand without hindrance, you would probably, as Mr. Thorneycroft states, make "char."

In our retorts (cast iron), the compression due to the expansion of the coal in course of carbonizing is so great that the surfaces of the coke column in contact with the sides of the retort are quite polished, so that there is no passage for the low-temperature gases to pass between the coke and the sides of the retorts; but the high vacuum keeps the core of the coke column sufficiently porous to allow of the easy evolution of the gases, which pass through the core of the coke column so quickly as to practically prevent decomposition or re-arrangement of the volatile hydrocarbons, which subsequently condense into oils.

Another point which tends to keep the coke dense is that it leaves the retort quite black and in shape conforming to the sections of the retort, so that no water is required for quenching purposes, and thus the disintegration of the coke is avoided.

I should now like to be permitted to deal with Mr. Thorneycroft's statements regarding the ammonia. He is reported to say: "The prior treatment of the coal for the recovery of the oils will reduce the total amount of ammonia obtainable by the simpler gas-producer plant; and it has to be proved that the value of the oils is greater than that due to the loss of ammonia." This statement is not to be readily understood, because the ammonia is not lost at all. If the coal is first carbonized, about 25 per cent. of the ammonia is recovered—the balance remaining in the coke; and if the coke is ultimately gasified, this balance, added to that recovered by the prior carbonizing process, will represent the total of the recoverable ammonia.

Of course, you can treat your raw coal straightway in a "producer" if it is not too bituminous for the "producer" to tackle; and the bulk of the ammonia is recoverable in the process of gasifying the coke. But it is clear that, by treating the coal in its raw state in a "producer," you destroy at once all the valuable hydrocarbons, the recovery of which, *plus* the ammonia by a prior low-temperature carbonizing, makes it more profitable to treat the coal thus rather than to gasify the coal off-hand in a "producer." At any rate, whichever way you select to treat the coal, the ammonia will not be lost as stated by Mr. Thorneycroft. Any manufacturer of producer-gas plant will tell you that a rich bituminous coal is their bugbear, being most difficult to gasify; and I have now in hand a bituminous coal which the producer-gas plant makers abandoned in despair. They have handed it over to us to first carbonize by low-temperature, yielding as it does a bountiful supply of oils; and the resultant coke (the very ideal fuel for a producer) will be handed back to them for gasification. Between us, we shall recover in the way of bye-products all this particular coal can possibly yield; and you may be assured we shall get the full practical yield of ammonia—the 1·3 per cent. of nitrogen in the coal represents.

19, *Queen Anne's Chambers, S.W., Oct.* 21, 1916. F. D. MARSHALL.

National Gas Council.

SIR,—It appears to me unfortunate that the result of the first meeting of this newly-formed Consultative Committee should give rise to dissension, instead of drawing together those which community of interest should unite. The Society of British Gas Industries has abundantly proved its usefulness, and is generally recognized as a body of capable technicians, formed to advance the interests of their members, and at the same time has done valuable work for the gas industry. The members of this body in many instances are prominent makers of gas apparatus, and are thus well qualified by their general experience and special knowledge to give assistance towards solving many of the problems that are continually arising. The decision to exclude representation of this one section from the Executive Committee seems to be illogical, seeing that they were invited to form part of the National Gas Council.

It is not surprising that certain of their members consider this an undeserved slight; and it is hoped, in the best interests of the industry, that steps will be taken to rescind this decision.

I am not sure that the present is an opportune time to form a National Gas Council, as to my mind our first business is to do all in our power to bring this sanguinary European conflict, in which we are fighting for our very existence as a nation, to a victorious issue, as unless we win the war nothing else counts. Most members during these strenuous times have more than enough to fully occupy their time, without being called upon to consider extraneous questions of future administration, which I think might have been allowed to stand over during probably the most critical of times in our history as a nation.

I cannot conclude without an emphatic protest against the discourteous allusion to Mr. Harry E. Jones in your last issue by one who does well to hide his identity under a *nom de plume*. Mr. Jones requires no encomiums from me. His record for many years past, as a progressive and gifted engineer of the first rank, is well known to most members of the industry; and his work is appreciated by those qualified to judge.

The Gables, Derby, Oct. 21, 1916. J. FERGUSON BELL.

Our "B.G.I." Report—A Correction.

SIR,—On p. 131 of this week's "JOURNAL," I see you have incorrectly reported me; and I shall be glad if you will make a correction in your next issue. What I said was that the Germans considered the "Manchester Guardian" was the only friend they had left among the daily papers in England.

Gothic Works, Edmonton, Oct. 19, 1916. A. P. MAIN.

Selling Gas for Industrial Purposes.

SIR,—With reference to my paper read before the North of England Association meeting, and which you are good enough to notice, will you kindly pardon me for drawing your attention to one or two points in your criticism.

I tried to make it quite clear that business could be divided into two classes: (1) That for which standard apparatus is suitable; (2) that for which special designs are necessary. I said that I favoured the policy of advising the makers to try to get the order; but my experience amply proves the necessity of keeping in touch with the consumer both before and after the order is placed.

With respect to the question of fixed gas and air regulation, the burner we use is the "Metro"—modified slightly as regards the gas-nipple to suit our gas. Although we have very varying pressures, a by no means constant calorific value, and sometimes water gas, yet the burner gives excellent results—much better than any other we have tried.

Where possible, we persuade the consumer to fix a governor on the meter; but this is by no means general.

The point I tried to make in answer to Mr. Tarratt's kindly criticism is that pressures vary from hour to hour, and alterations cannot possibly be made to the adjustments, if provided, to suit all of them. I think I can have our Chief Engineer's assurance that the adoption of a standard burner has not in any way placed any limitations on his methods of manufacture that did not exist before.

The standpoint from which I hope I will never have to recede is that all ideas must be made subservient to the ultimate and permanent satisfaction of the consumer; and, taking this as the standard, our policy has been amply justified.

Newcastle-upon-Tyne, Oct. 19, 1916. A. B. ROXBURGH.

Transfer of German Interests to British Control—The British Mannesmann Tube Company.

SIR,—I desire to draw attention to the above matter in order to illustrate one instance where the presumably good intentions of the Public Trustee in transferring German-owned concerns into British hands have apparently miscarried.

The British Mannesmann Tube Company was the property of German interests resident in Germany; and these interests have recently been sold by the Public Trustee to a British financial group, the first Directors of which are given in the Press as follows:

Mr. Richard S. Guinness (Chairman).
Sir Robert Balfour, M.P.
Sir Hugh Bell.
Mr. G. Hethey (Managing-Director).

The announcement to the Press was doubtless intended to convey the impression that this previously well-known German concern had now become British; but the real facts disclose a state of affairs quite different. In other words, while the ownership of the business has passed into British hands, the actual management of the business remains in the hands of individuals of German birth.

On patriotic grounds, it is to be regretted that the Board of this British Syndicate should have appointed as one of their colleagues and Managing-Director, an individual of German birth, and whose commercial career as head of the German Mannesmann interests in this country has been entirely associated with, and supported by, German interests; also that they should further allow two important positions in the Company to be occupied by two sons of the said individual, of military age, born in Germany of German parents.

In other words, here we have an instance of the Public Trustee selling a German-owned company to a British financial syndicate, which—whether for want of knowledge of the business themselves, or other motives—allows the business to be continued under the previous German inspired management.

Apart from the question of patriotism and of the obvious desirability of cleansing our industries of German influence, it seems to me almost

incomprehensible that the Public Trustee, who is apparently empowered to negotiate by private treaty for the disposal of these German-owned concerns, should not be required to satisfy himself that the sale will have the effect of converting the previous German concern into a British concern *in toto*.

E. J. Fox.

32, *Roland Gardens, S.W., Oct.* 19, 1916.

REGISTER OF PATENTS.

Cracking Hydrocarbons.

Lewis, G. P., of Brixton, S.E.

No. 12,188; Aug. 24, 1915. No. 2509; Feb. 19, 1916.

It is pointed out by the patentee that it has been previously proposed to effect the cracking of hydrocarbons—that is to say, the conversion of them into bodies of lower specific gravity and reduced boiling point—by processes consisting of three stages, and carried out by means of apparatus constructed in sections corresponding with the stages, and wherein the hydrocarbon material is heated and vaporized in a distillation vessel or still, the vapours therefrom, either with or without the aid of a circulating current of permanent gas (for example, hydrogen, nitrogen, carbonic acid gas, methane, or gases obtained from the distillation itself) or steam introduced in the first stage, being conducted into, and further heated in, a cracking chamber, which may be independently heated, and thence into a reflux condenser, wherein the products boiling above a predetermined temperature are condensed and returned to the first stage or still or to the vapour-heating stage or cracking chamber for re-treatment—all of the operations being carried on under pressure.

The present combined invention consists in improvements in the processes and apparatus therefor, in accordance with which means are provided whereby the temperature in the condensing stage can be regulated, and with a view to breaking-up the gases from the cracking chamber and causing them to be intimately mixed, the gases in passing from this chamber to the reflux condenser may be brought in contact with fragments of solid material of either catalytic or non-catalytic effect. As regards the use of catalytic material, the inventor admits that, in some already known methods of transforming heavy hydrocarbons into light easily vaporizable hydrocarbons, it has been proposed to pass the vapours over heated metallic oxide or other catalysts; and he makes no claim to the mere employment of catalyzers, but only to their use in conjunction with his improved re-vaporizing step.

Gas-Burners for Biscuit Ovens.

Keith, J. & G., of Farringdon Avenue, E.C.

No. 13,836; Sept. 29, 1915.

This invention relates more particularly to burners provided with an outlet extending longitudinally of the burner tube, as described in patent No. 22,762 of 1914—a prior specification of the inventors.

In practice, it is found that the burner then described tends to burn more gas at the end adjacent to the injector than at the remote end; there being a gradual diminution of the volume of gas consumed along the length of the burner proceeding from the end adjacent to the injector, whereas generally with similar long burners used for heating with different forms of outlet, the tendency is for the consumption to increase towards the end remote from the injector.

Particularly in connection with the adaptation of such burners to biscuit ovens, where the burners are disposed transversely of the chain on which the biscuit pans move, provision should be made for controlling the delivery of the combustible mixture at different points along the length of the burner. Indeed, this would be the case (say the patentees) even were the burners designed to deliver the combustible mixture uniformly, as cooling influences may affect different parts of the oven differently, and, on account of changes in conditions, it is important that an attendant on the spot should be able to effect the necessary adjustment. Practically adequate results may be obtained by increasing temporarily the heating effect of one end of the burner at the expense of the other, as may be effected by the present suggested arrangements.

Broadly regarded, the invention consists in a gas-burner comprising a tube provided with a longitudinal apertured partition or diaphragm dividing the tube into separate chambers—one such chamber being made with an outlet in the form of a continuous slot extending longitudinally of the tube, and the other chamber communicating with the first by way of the apertures in the partition. A valve device is fitted to the tube adjacent to the inlet end, and is adjustable to control the distribution of the inflowing mixture so as to confine the mixture to enter the second compartment or in part to bye-pass the compartment.

Gas-Fired Furnace.

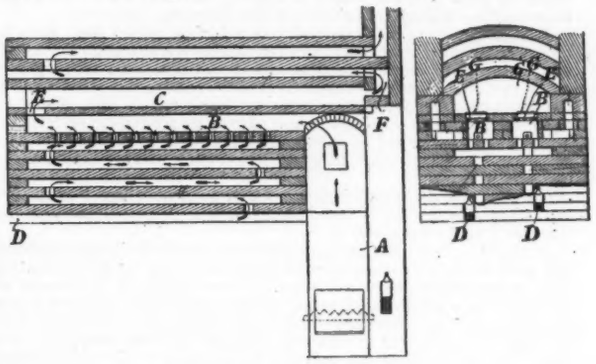
Price, C. F., of Nechells, Birmingham.

No. 14,668; Dec. 29, 1915.

These furnaces are of the type in which the secondary air supply is arranged to traverse, on its way to the combustion chamber, one or more superimposed passages or chambers heated by the furnace, so that the air is in a heated condition when it enters the combustion chamber.

A longitudinal section is given through a gas-fired furnace according to this invention (particularly adapted for annealing hard or soft metals), also a transverse section.

The furnace is combined with a gas-producer A, the gas passing through an opening in the top of the latter into the combustion chamber B, whence it is mixed with the secondary air supply and ignited. The chamber is arranged directly beneath the muffle C, so that the metal in it is "subjected to intense heat." In order to obtain a more complete combustion of the gas in the combustion chamber, the secondary air inlet D is disposed at one end of the base of the furnace, and the air is arranged to traverse a number of superimposed passages beneath the combustion chamber. The upper passage is in communication with the latter by means of a number of openings through which the air passes. The products of combustion pass into the muffle chamber at one end through an opening E, and out at the opposite end through a passage F, along flues arranged longitudinally



Price's Gas-Fired Furnace.

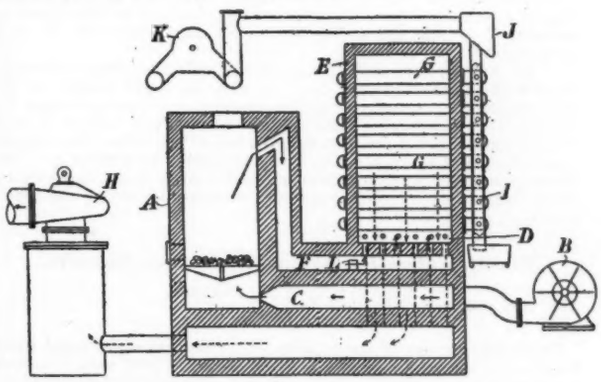
above the muffle chamber one above the other, and thence to the chimney. The opening leading from the combustion chamber to the muffle is arranged to be closed by a damper (shown by dotted lines) at G, so as to shut off the products of combustion from the muffle—the heating gases being, in this case, arranged to pass through flues at each side of the muffle chamber into the main flues above the latter. An enclosed muffle is thus formed which admits of the metals being annealed without blistering or scaling due to the flames coming into contact with them.

Operating Coal-Gas Plants.

White, A. E., a communication from the Riter-Conley Manufacturing Company, of Leetsdale, Penn., U.S.A.

No. 16,269; Nov. 18, 1915.

This invention relates more particularly to apparatus in which coal is placed within retorts arranged in a chamber heated by a gas-producer. It is well known, the patentees points out, that the walls of such refractory material retorts permit leakage of gas, and especially under the varying pressure conditions which arise in practice both inside and outside the retort. In some apparatus, the retorts are at times below atmospheric pressure, in which case the producer gas leaks from the combustion chamber into the retort, and thereby adulterates the coal gas. On the other hand, where the pressure within the retorts exceeds that of the combustion chamber, the coal gas will leak out through the walls of the retort and be consumed in the combustion chamber, thereby causing waste.



Riter-Conley Method of Operating Coal-Gas Plants.

In the preferred method of carrying out the invention, the pressure within the retort during the normal operation is maintained somewhat greater than that within the combustion chamber, with the retort pressure predominating just enough to force some of the carbon in the retort into any cracks that may exist in the retort walls, and prevent the escape of gas. It is also preferable to maintain the pressures both inside and outside the retort below atmospheric pressure, "as the slight vacuum maintained within the retort throughout the carbonization period facilitates the gas-liberating process; and the absence during the carbonization period of sensible pressure minimizes the forming of carbon." The pressure within the retorts is preferably maintained substantially uniform throughout the entire operation.

Prior to the present invention, the patentees claim that it has been proposed to treat the walls of gas-retorts in order to make them gas-tight by establishing a difference of pressure between opposite sides of the material and forcing hydrocarbon gas or vapour, by means of this pressure, into the pores and other openings which may exist in the mass of the material from one side thereof, and causing the deposition of carbon from the gas or vapour into such pores by heat transmitted

from the other side of the material. In this proposal there is no suggestion that the requisite pressure conditions obtain throughout the normal working of the retorts; and apparently such conditions are involved only during a preliminary stage. In such circumstances, if the external pressure predominates, the carbon which is deposited in the pores will tend to be forced out into the retort, and the heating gases will mix with the retort gases. The present invention, in short, relates to a method of operating the retort to prevent leakage by maintaining definite pressure conditions throughout the operation of the retorts; while the prior proposal relates to treating the retort walls with a view to preventing leakage irrespective of the operating conditions.

The gas-producer A is supplied with a bed of ignited fuel, and, by means of the blower or fan B, primary air is forced through the flue C, and reacts with the incandescent fuel in the producer, forming producer gas, which passes through flues to the combustion chamber D of the retort chamber E; the producer gas being mixed with secondary air entering through openings F, and passing up around the retorts G to distil the coal contained in them. The products of combustion pass downwardly through flues shown in dotted lines, and are drawn off by the exhauster H.

The gas from the retorts is drawn off through openings I in the retort mouthpieces into a stand-pipe, whence it passes through the chamber J to the exhauster K.

A valve L is provided for regulating the pressure in the gas-producer and particularly for maintaining the pressure at the top approximately equivalent to atmospheric if desired. The exhauster H is operated to continuously maintain a pressure in the combustion chamber lower than retort pressure, and preferably below atmospheric pressure. The exhauster K is operated to withdraw coal gas from the retorts in such manner as to maintain the pressure within them below atmospheric pressure, but at the same time to maintain the pressure within a given retort somewhat greater than the pressure at the exterior of it. The higher pressure within the retorts has the effect of forcing carbon into, and sealing, the cracks that may exist in the retort walls, preventing the escape of coal gas into the combustion chamber. The pressure in the combustion chamber being lower than that of the retort, there is no tendency for the producer gas to enter the retort.

The invention is said to be particularly applicable to gas-benches comprising a relatively large number of superposed retorts—for instance, eight retorts, as illustrated; and in the preferred use of the invention, "care is taken to maintain a pressure below atmospheric, even at the top of the combustion chamber."

Drying Vapour in Connection with Benzol Stills.

MITCHELL, J. E., and MORFEY, H., of Barnsley.

No. 17,568; Dec. 16, 1915.

This invention relates to apparatus for drying vapour—primarily intended for use in connection with benzol and other stills, the chief object being to construct a drier that will free the vapours produced in the distillation of benzol from any products in liquid form which may be carried over during distillation.

The drier comprises a vessel having a tangential inlet and a central outlet, and one, two, or more concentric tubes having circulating apertures near their alternate ends, and with their lower ends arranged to be closed by a liquid seal maintained at a constant level by a liquid outlet. The vessel and tubes are preferably cylindrical, and the tubes form a connection with the top of the vessel and extend close to the bottom of it. The tangential aperture is situated slightly above the level of the liquid seal, and the circulating apertures are formed near the top of the outer tube, slightly above the level of the liquid seal in the next inner tube and alternately in each succeeding tube, if more than two tubes are employed.

If the apparatus is used in connection with a dephlegmator, the vapour leaving the latter is caused to enter the lower portion of the drier tangentially, thereby depositing much of its suspended liquid by contact with the inner surface of the vessel. The contact is still further carried on in the two inner tubes of the drier; the vapour finally leaving the central outlet in a practically dry condition. The lower ends of the concentric tubes are sealed in the liquid so separated and which may be returned to the still or lower portion of the dephlegmator.

Mixing Tubes for Atmospheric Gas-Burners.

HUNTER, T. M., of Glasgow.

No. 17,993; Dec. 24, 1915.

These burners are of the type in which the gas is delivered from nozzles into a mixing-tube in which the cross sectional area increases gradually from the throat to the outlet end, with an adjustable arrangement for the admission of air at the end of the mixing-tube which is next to the gas inlet. The cross sectional area may thus be readily varied and permit of the burners being used with varying gas pressures, while controlling the position where the gaseous mixture ignites and lessens the risk of it "firing back" and burning from the nozzle.

A mixing-tube made according to the invention comprises essentially a tube of gradually increasing cross sectional area from the throat part outwards, and a plate or plates made to fit the inner side of a part or parts of the surface of the tube, and so pivoted at the end nearest the throat that it or they lie on the surface of the tube; means being provided such that the angular position of the plate or plates may be adjusted, thus varying the cross sectional area of the tube.

Front elevations and longitudinal sections showing two examples of the invention are given.

In fig. 1, the gas is delivered from the nozzle A into a mixing-tube B, which is rectangular in cross section and of gradually increasing area from the throat or nozzle end outwards. Air is admitted to the mixing-tube, by passages C D, at the end next the gas-nozzle; the inlet to the passages being controlled by endwise movable aperture plates E G. Within the tube B two plates H I are hinged at their inner ends; the hinges being in recesses in the upper and lower sides of B. The plates are of such dimensions as to fit and cover the entire width of the inner surface of the upper and lower sides of the tube. The plates are positioned within the tube by adjusting screws J K passing through apertures in the wall. The area of the mixing-tube B may in this way be regulated to suit varying gas pressures, and thereby lessen the risk of "back-firing."

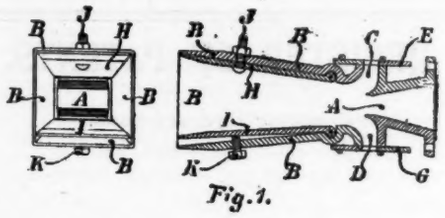


Fig. 1.

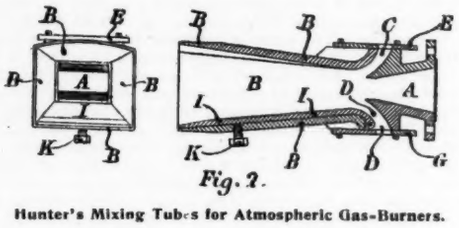


Fig. 2.

Hunter's Mixing Tubes for Atmospheric Gas-Burners.

In fig 2 (applicable to the circular furnace boiler flue to be fired simultaneously with coal and gas), the upper part of the mixing-tube B is so curved that it conforms to the shape of the curved upper side of the furnace flue; the lower side of the mixing-tube in this case being flat, and the burner extending more or less through the furnace front above the furnace door. One plate I is used to vary the cross sectional area of the mixing-tube B; this plate being shaped to fit the inner surface of the lower side of the tube and being hinged at its inner end in the passage D.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Oct. 18.]

Nos. 14,300—14,648.

ADAMS, M. J.—"Gas stove or furnace." No. 14,436.
BENN, J. B.—"Taps or cocks." No. 14,596.
HALL, A.—"Valves, cocks, &c." No. 14,577.
JOHNSON, A.—"Coal-conveyors." No. 14,487.
KUHL, P. C.—"Gas-turbines." No. 14,512.
LENNOX, A. B.—"Stills and retorts for distilling coal tar, &c." No. 14,551.
MARSHALL, C. L.—See Lennox. No. 14,551.
TEBBS, H. E.—See Benn. No. 14,596.
TWEEDY, W.—See Lennox. No. 14,551.
USSHER, L.—See Hall. No. 14,577.

RESTORATION OF LAPSED PATENT.

Notice is given that an order has been made restoring the letters patent granted to CHARLES CLAUDE CARPENTER for an invention entitled "Improvements in inverted incandescent gas-burners," No. 5289 of 1909, bearing date March 4, 1909 (and the patent of addition No. 25,874 of 1911 for "Improvements in inverted gas-burners," bearing date Nov. 20, 1911).

APPLICATION TO AVOID OR SUSPEND A PATENT.

No. 28,072 of 1912.—Grantee: CARL STILL, The Firm of—"Direct recovery of ammonia from products of the destructive distillation of coal, &c." Applicants: Bagley, Mills, and Co., Limited.

Manchester Corporation War Bonuses.—It has been decided by the Special Committee of Chairmen and Deputy Chairmen of Manchester Corporation departments to ask the Council to adopt a resolution that, in lieu of the war bonus granted previously, a war bonus of 4s. per week be given to every adult male person in the employment of the Corporation receiving wages or salary not exceeding 40s. per week; that to those who are in receipt of between 40s. and 60s. per week, the bonus be 3s. per week; and that one-half of the increase be given to female employees and persons under 21 years of age—certain sections of employees being exempted as heretofore.

Another Case of "T.N.T." Poisoning.—At an inquest held at Faversham last week, on the body of Winifred Oldfield, age 21, who had been employed at a munition factory since June, the Jury returned a verdict to the effect that death resulted from "T.N.T." poisoning. Dr. Benjamin Moore, of the Medical Research Committee's staff, said it might be desirable, in order to allay any alarm, to state that only one person in 100 or 200 was affected by "T.N.T." poisoning. It was a question of susceptibility. Some of the most sickly-looking persons had been engaged on the work for over a year, and had never had "T.N.T." sickness. A conclusion he had come to as the result of investigation was that when a worker was known to have "T.N.T." jaundice, he or she should never return to the work. With a little organization, it should be possible to transfer such workers to other munition employment.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

British Mannesmann Company.

Sir JOHN LONSDALE, in the House of Commons last Wednesday, asked the President of the Board of Trade if he was aware that the British Mannesmann Tube Company, Limited, whose share capital had recently been sold to a group of British financiers, was still being managed by a naturalized German and his two sons; and whether it was proposed to allow this firm, which is engaged in munition work and holds contracts with the Admiralty and other Government departments, to be controlled by persons of enemy origin. He also put a similar question to the Secretary of the Admiralty.

Mr. PRETYMAN replied that the British Mannesmann Tube Company was not controlled by persons of enemy origin, but was under the control of British subjects.

Dr. MACNAMARA supplemented this pronouncement by stating that he understood the capital of the Company was now almost entirely held by natural born Britons. The Board of Directors consisted of four gentlemen, three of whom were British born subjects, and the fourth, the Managing-Director, was a naturalized British subject of German origin. He believed it to be a fact that the last-named was assisted by his two sons, who wore the badge "On War Service" issued by the Admiralty. The firm was a controlled establishment, and the Company held Admiralty contracts.

Ellesmere Port Dye-Works.

Sir HENRY DALZIEL on Thursday asked the President of the Board of Trade whether the Ellesmere Port Dye-Works, owned by Germans resident in Germany, had been leased to Messrs. Levinstein, of Manchester; whether the concern, British Dyes Limited—a Company in which £1,000,000 sterling of British money had been invested—was given an opportunity of tendering for the works; and, if not, could he give the reason?

Mr. RUNCIMAN: The Port Ellesmere Works of Messrs. Meister, Lucius, and Bruning have been sold, under the provisions of the Trading with the Enemy Acts, to Messrs. Levinstein Limited. Full guarantees have been given by Messrs. Levinstein that the Company shall always remain under British control. The Board of Trade took the advice of scientific experts on the evidence submitted by Messrs. Levinstein and British Dyes Limited, as to their respective ability to utilize the works in question for the manufacture of synthetic indigo. As it appeared from the report of the referees that, on the evidence submitted, Messrs. Levinstein were better qualified to carry on this particular manufacture by the process for which the Port Ellesmere plant was designed, the Board considered that no useful purpose would have been served by inviting competitive tenders, provided that Messrs. Levinstein were prepared to pay a price considered reasonable by the Court.

Sir H. DALZIEL: Do you suggest that the experts advised that British Dyes Limited should not have an opportunity of tendering? Did they have an opportunity of tendering?

Mr. RUNCIMAN: No, Sir; they did not have an opportunity of tendering, because the referees advised that Messrs. Levinstein were better qualified to carry on this operation by the process that was established at the Ellesmere Port works.

Mr. BOOTH: Are we to understand that the selling price to this firm was really fixed by the Government?

Mr. RUNCIMAN: No; the Government had no choice in the matter. The selling price was considered reasonable by the Court, and was not fixed by the Government.

"T.N.T." and Munition Workers.

Lord HENRY CAVENDISH-BENTINCK asked the Home Secretary whether his attention had been called to the fact that two deaths of female munition workers from T.N.T. poisoning had recently occurred; whether he had considered if they were due to the probability that the regulations were either defective or badly administered; and what steps he proposed to take in order to make the regulations in this process really effective to safeguard the health of the workers?

Mr. BRACE: The Home Office has received reports with regard to these two cases. The question of T.N.T. poisoning is receiving the close attention of the Home Office and the Ministry of Munitions, and special measures have been taken for dealing with it. Further modifications of the regulations are under consideration. The problem is a new one, and is made more difficult by the fact that the manufacturing processes are constantly being modified. The precautions which are now required, or under consideration, include all the measures which the experience so far obtained suggests, and further investigations, and experiments with new methods and appliances, are being made.

Sulphate of Ammonia Exports to Holland.

Mr. ACLAND, replying to Viscount Wolmer, said: The quantities of British-made sulphate of ammonia exported to the Netherlands from 1912 were as follows: 1912, 2216 tons; 1913, 2872 tons; 1914, 9074 tons; 1915, 31,741 tons; nine months ending Sept. 30, 1916, 6977 tons.

New Work for Lamplighters.—A Sub-Committee have suggested to the Birmingham Corporation Lighting Committee that work of a different nature should be found for the lamp-lighting staff. They stated that the number of the staff prior to the war was 220; and of these, 79 were with His Majesty's forces, 18 were waiting to be called up, and 33 had left the service. There were thus 90 to be dealt with. Of these, six were lamplighters, and 22 were required for various works; so that there were 62 men whose services could be utilized for other purposes. They recommended that the City Surveyor be instructed to approach the various departments, and ascertain whether they could avail themselves of the services of lamplighters who could be dispensed with for the present; and that, in the case of those who were not employed, they be allowed to take up munition work.

LEGAL INTELLIGENCE.

CONTRACT INTERRUPTED BY THE WAR.

Metropolitan Water Board v. Dick, Kerr, and Co., Limited. Judgment.

In the King's Bench Division of the High Court of Justice last Wednesday, Mr. Justice BRAY gave judgment in the above case, which was argued before him last July [see "JOURNAL," Vol. CXXXV., p. 261].

His LORDSHIP said the action was brought for a declaration that a contract for the construction of two reservoirs and works at Littleton, Middlesex, dated July 24, 1914, as modified by a supplemental contract of May 10, 1915, was still in existence and binding on defendants, and had not been determined. They also claimed a declaration that they were entitled to certain plant, tools, and materials brought on to the site of the works by the defendants, and the proceeds of sale of such as had been removed since Feb. 21, 1916, or, alternately, damages for their conversion by the defendants, and an injunction to restrain them from removing any plant, tools, and materials from the site. Defendants, as to the contract, claimed that, by a notice from the Ministry of Munitions of Feb. 21, 1916, they were required to cease work; and by reason of such notice the performance of the contract became impossible and illegal, and the contract had ceased to be in existence as a binding contract. As to the tools, plant, and materials, they denied that they were the property of the plaintiffs, and said, further, that they were dealt with by the defendants under the instructions of the Ministry of Munitions. The two reservoirs covered a space of ground one-and-a-half miles by nine-tenths of a mile, and the embankment was over six miles in length. The contract price was £673,000. The works were commenced on Aug. 16, 1914; and a large quantity of plant was brought on the ground and installed by the contractors from time to time. On May 10 the supplemental contract was entered into. By this the work was varied—instead of two reservoirs, there was to be only one, occupying the same space as the two. By this contract the prices were revised—mostly in favour of the contractors. The period for construction was not altered. At the time of the stoppage of the works the expenditure by the contractors was: Plant, £90,921; hauling and installation of plant and sundry necessary works, £26,126; permanent work £56,395. In respect of it, defendants had received under certificates of the Engineer about £40,000. Owing to difficulties in procuring labour, the Board offered to grant an extension of time, but refused a revision of prices. On Feb. 21, defendants were requested by the Minister of Munitions to restrict the work with a view to the production of munitions being increased elsewhere. On Feb. 26, work at the reservoirs practically ceased; and large quantities of plant were removed and sold. At the beginning of May the defendants set up the contention that the contract had been determined by reason of the further performance thereof having since become impossible and illegal. The important question as to what circumstances would constitute a determination of a contract had been recently before the House of Lords in *Horlock v. Beal* and *Tamplin Steamship Company v. Anglo-Mexican Petroleum Products Company*. In the latter case, Lord Parker explained the principle which underlay the cases. He said that the principle was one of contract law, depending on some term or condition to be implied in the contract itself, and not on something entirely *dehors* the contract, which brought the contract to an end. It was, of course, impossible to imply in a contract any term or condition inconsistent with its express provisions, or with the intention of the parties as gathered from the provisions. The first thing therefore in every case was to compare the term or condition which it was sought to imply with the express provisions of the contract and with the intention of the parties as gathered from the provisions, and ascertain whether there was any such inconsistency. He had therefore to examine the nature and the express conditions of this contract. The contract was for the construction of a very large work to be completed within six years, subject, however, to such extensions of time as were granted by the Engineer. Clause 32 provided that if, by reason of any additional works, or by reason of any difficulties, impediments, obstructions, oppositions, doubts, disputes, or differences, the contractor should, in the opinion of the Engineer, have been unduly delayed or impeded in the completion of the contract, it should be lawful for the Engineer to extend the time without thereby prejudicing, or in any manner affecting, the validity of the contract, or the adequacy of the contract price; and any such extension should be deemed to be in full compensation and satisfaction for, and in respect of any and every actual or probable loss or injury sustained by, the contractor. The event which had happened was therefore provided for, as the intention was to include every possible event which might unduly delay or impede the completion of the contract; and the words "any difficulties, impediments, whatsoever or howsoever occasioned," were quite wide enough to include the interference of the Minister of Munitions. No doubt the contract was entered into before the war, and the event of war probably did not enter into the minds of either of the parties. Nevertheless, if their intention was to include every difficulty or impediment they must be held to have intended to include such a difficulty or impediment as had arisen here. There was no reason for giving these words anything but their natural construction. The next point to consider was whether, in the events that had happened, the object of the contract had been frustrated, or its completion rendered impossible or commercially impracticable. This was a pure question of fact. The object was not frustrated merely by delay. Plaintiffs wanted a reservoir to last all time. It was, of course, important to them that there should be no undue delay beyond the six years; but they would eventually get the reservoir, which was their object. Defendants wanted the opportunity of constructing the works for payment to them, and they would get their opportunity and their payment, though not as soon as they hoped. A delay of two years, or even longer, would not frustrate the contract. He could not hold that

the completion of the work contemplated by the contract was physically impossible; and therefore he must declare that the contract was not determined. As to the plant, tools, and materials, clause 10 vested in the plaintiffs all the property brought on to the site until the completion of the works; and therefore he must hold that the plaintiffs were on Feb. 21, 1916, entitled to all the plant, tools, and materials which were then on the site of the works. With regard to the proceeds of the sale of part of the plant (about £50,000) received from the Minister of Munitions, the defendants were not liable either to pay the proceeds of sale to the plaintiffs, nor to pay damages for their removal or conversion, so far as they acted as agents of the Minister of Munitions, as they had done with regard to the claim for an injunction. Defendants had not confined themselves to justifying their acts as having been done under the instructions of the Minister of Munitions; they had asserted that the plant was theirs, and that they had a right to deal with it, and therefore plaintiffs were entitled to an injunction.

THE SPENBOROUGH WATER ARBITRATION AWARD.

Unsuccessful Motion to Set It Aside.

A motion to set aside the arbitration award [see "JOURNAL" for July 4, p. 37] fixing the price to be paid by the Spenborough Urban District Council to the Bradford Corporation for water supplied in bulk at 7d. per 1000 gallons came before Mr. Justice Eve in the Chancery Division last Friday week. The Arbitrator (Mr. G. J. Talbot), when fixing the price, said that it was intended to represent the cost to the Corporation of the water supplied to the Council, including payment of the sinking fund in respect of loans, without any addition in respect of risk, profit, or otherwise.

Mr. HUGHES, K.C., for the Corporation, explained that they supplied water to places outside the city under their Act of Parliament; and these included the Spenborough urban district. The Council questioned the price; and under the Act it was referred to an Arbitrator. Counsel submitted that this gentleman went on the wrong lines, and that in arriving at a price to be paid over a period of 20 years he had really taken the present price without any addition for the certainty of the rise in the future, or anything in respect of contingencies. The Arbitrator had given the reasons for his award, which (said Mr. Hughes) was a very unsafe thing to do. If an Arbitrator just gave the result of his decision, there was a good deal of difficulty in getting behind it; but when he gave his decision on a point of law, the Courts could always review his finding. Mr. Hughes went on to say that the Corporation had spent £4,000,000 on their water undertaking and had to spend something approaching another million; and at the arbitration it was pointed out on their behalf that there had been a great increase in wages and the cost of materials, and also in the rates of interest on loans. Probably for some years to come, local authorities would be unable to borrow money at less than 5½ per cent. He also pointed out that the Corporation took all the risk—the Spenborough Council being merely a customer.

Mr. VESEY KNOX, K.C., on behalf of the Spenborough Council, said that since 1862 the urban district had been tied to the Bradford Corporation for water, and could not even take water from wells in their district. The Act of 1913 was intended to remedy a position of injustice.

Mr. HUGHES said he did not think the Bradford Corporation, though very kind to the outside districts, could be said to have brought in the Bill for the benefit of Cleckheaton and district.

Mr. KNOX: The Bill was passed in a very different form from that in which it was introduced. Counsel went on to say that in the Act special provision was made to prevent their being charged too much. The Corporation were to bear the risks and to charge Spenborough the same price as was charged in the city limits. The whole scope of the provisions in the Act affecting the urban district of Spenborough was to protect them against any possibility of injustice; and the provisions were somewhat unusual in an Act of this kind. He submitted that the Arbitrator had correctly allowed for all risks capable of human estimation, and had refused to add a covering percentage. This was a question of fact for the Arbitrator alone, and not one of law; and therefore his award ought not to be set aside or remitted.

His LORDSHIP, in giving judgment refusing to set aside or remit the award, said he did not think that the Arbitrator had made any mistake in law. What he had done was to settle the price at 7d., with the information that this price was the cost price. In arriving at the figure he had included the payments to be made in respect of the sinking fund, but nothing in respect of contingencies. The motion would be dismissed, with costs.

Incandescent Gas-Mantle Litigation.

In the Court of Appeal last Tuesday, Lords Justices Swinfen Eady and Bankes and Mr. Justice Lawrence heard cross appeals in the action of *United Chemical Works, Limited, v. Sadür*, which was tried by Mr. Justice Darling and a Special Jury in June of last year.* The plaintiffs sought to recover £61 9s. 6d., the price of a quantity of "Guarantee" mantles and "Seconds." Defendant, a wholesale grocer of Stepney, admitted purchasing the mantles, but said the plaintiffs were not entitled to claim the money, as they were agents for German principals. Further, he sought, on a counterclaim, to recover £111 1s. 6d. damages for breach of contract, as, owing to the outbreak of war, the plaintiffs were unable to fulfil his order, and he had to purchase mantles elsewhere. The Judge held that plaintiffs were not a German company, but an English one, and so were entitled to maintain the action. He therefore directed the Jury to find for them for the amount of the claim; and on the counterclaim the Jury returned a verdict for the defendant for £73 17s. 6d. In the Court of Appeal, Mr. Wallace, K.C., for the United Chemical Works, said he would at once admit that there was not a single shareholder in the Company except Germans; while all the Directors were also Germans. But a Mr. Harris, an Englishman, was appointed Manager by an agreement dated Oct. 1, 1913; and Counsel urged that this agreement gave Mr. Harris power to bring an action in the name of the Company. He contended that this was so according to the proper interpretation of the Articles of Association, although there was no express authority for the purpose. Counsel relied upon the fact that Mr. Harris had the right to collect the debts of the Company. Without calling upon Counsel on the other side, the Court held that Mr. Harris had no authority whatever to bring the action. Their Lordships accordingly set aside the whole of the proceedings, both in that Court and in the Court below, allowing no costs to either party.

* See "JOURNAL," Vol. CXXX., p. 656.

Dispute over a Gas-Engine and Producer Plant.

The Lord Chief Justice and Justices Ridley and Low, sitting in the King's Bench last Friday, had before them an application for a ruling on behalf of Messrs. Rowe Bros. and Co., of Liverpool, in connection with an arbitration between them and Messrs. Crossley Bros., of Manchester. Mr. Langdon, K.C., said Messrs. Rowe Bros. were white lead and paint manufacturers, who purchased from Messrs. Crossley Bros. a gas-engine and gas-producer plant. There was a clause in the contract to the effect that all matters in dispute should be referred to arbitration; and that in the arbitration neither of the parties should be represented by counsel or solicitors. Disputes arose, and an arbitrator was appointed; and Messrs. Rowe selected Mr. Thomas Davis, an engineering expert, to put their case before the tribunal. Messrs. Crossley Bros. objected to Mr. Davis appearing; and the Arbitrator submitted the point as to whether it would be right to allow Mr. Davis to appear in the arbitration. The Lord Chief Justice, in stating the decision of the Court to send the matter back to the arbitrator to exercise his discretion as to allowing Mr. Davis to appear, said he must use his judgment.

MISCELLANEOUS NEWS.

STRIKE OF DUBLIN GAS WORKERS.

A Settlement Pending Arbitration.

A fresh trouble confronted the Alliance and Dublin Consumers' Gas Company, last Saturday week, when some 250 men employed in the distribution department struck work—giving as a reason that demands made by them for an increase in their wages had been refused.

Though the strike was at first confined to this particular branch of the service, it was quite expected that the trouble would spread to the retort-house men at the Brunswick Street works, who were declared to be in an unsettled state. This expectation seemed to be justified when the latter employees gave notice of their intention to cease work on the Thursday, if the demand for an increase of wages were not acceded to. Instead, however, of getting worse, the situation improved; and towards the end of the week, the welcome news came to hand that a temporary settlement had on Thursday evening been effected, with the result that all the workers, including a man whom the employees claimed had been unjustly dismissed, were to resume work on the Friday morning. During Thursday, conferences were held between the Directors of the Company and the men's representatives; and then it was announced that the whole question in dispute was to be referred to arbitration within the next fortnight, and that in the meantime the members of the Transport Workers' Union, who got an increase of 2s. per week recently, were to have an addition of 1s. to their weekly wages, while the other men were to receive an increase of 2s. 6d. a week. In view of this settlement, of course, the workers at Brunswick Street did not carry out their intention of stopping work. The arbitrators are to be a representative selected by the Company, a representative of the employees, and an independent Chairman appointed by the Board of Trade panel.

BIRMINGHAM GAS DEPARTMENT LABORATORY.

In a report to the Birmingham City Council, the Gas Committee announced [*ante*, p. 141] their intention of extending the scope and work of the laboratory set up by them six years ago, and recommended that the staff be placed upon a basis to cope with the larger scheme. The demands on the laboratory during the past twelve months have been very heavy; and they will, of course, be much greater still when all the new arrangements are completed.

Dealing with the Committee's proposals, "Metal Industry" says that provision has now been made for four departments of laboratory work. One will be devoted to testing the strength of materials by means of tensile, torsion, bending, impact, and hardness tests; and a 25-ton machine is to be introduced. A second department, for which special dark rooms and apparatus are being equipped, provides for metallo-graphy on a fairly extensive scale; dealing with the microstructures of steels, brasses, bronzes, and various non-ferrous alloys. The scheme includes an extension of the foundry, in which special work has been done in the past relative to heat treatment. To carry out this more complete work, qualified metallurgists have already been engaged. An important feature is that, to the fullest possible extent, works conditions, as distinct from laboratory conditions, are here reproduced. It is this element which has developed a great amount of mutual confidence in the past between those carrying on the laboratory and manufacturers. An enormous number of experiments have been carried through with almost every variety of metal. Many of these have been of the greatest assistance to manufacturers in

meeting special Government tests, and incidentally, therefore, are of great use in promoting the supply of war materials. One of the most encouraging features has been the complete confidence existing between the department and the manufacturers assisted; and it is hoped that this will be continued with advantage to all concerned. The achievements of the laboratory give every encouragement for future usefulness. The work done has embodied the latest scientific knowledge and manufacturing practice. Since the outbreak of war, various branches of manufacture formerly almost wholly in the hands of the Germans have been made possible in Birmingham through scientific applications of gas heating. Indeed, it is claimed that new industries have really been established in this way. The work will take first a general, and secondly a more scientific form. A great deal of general investigation will be carried on, the results of which will be available to all; while, side by side with this, there will be carried on various confidential investigations having in view specially the individual manufacturer who may have a promising idea, but has not the necessary equipment to convert it into a commercial proposition.

The scheme has been generally outlined by Captain R. S. Hilton, the Secretary and Manager of the Gas Department, and has been worked out under the direction of Mr. C. M. Walter, B.Sc., the Superintendent of the Industrial Heating Department. Mr. Walter has now been appointed Engineer-in-Charge of the laboratory, with Mr. Victor E. Green as Assistant Engineer.

The proposals of the Committee were agreed to at last Tuesday's meeting of the City Council.

SOUTHEND TOWN COUNCIL AND THE GAS COMPANY.

Committee's Inquiry Regarding the Price of Gas.

The Special Committee of the Southend Town Council appointed to consider the possibility of effecting a reduction in the price of gas in the portion of the borough which is within the Southend Gas Company's area of supply have issued their report. After pointing out that their instruction included an inquiry as to whether a reduction in the cost of gas could best be effected by the purchase of the Company's undertaking, the Committee say that the Southend Gas Acts do not prescribe any maximum price which may be charged for gas, but seek to ensure that the price shall not be excessive by providing that the rate of dividend shall fall as the price of gas rises. Thus, in theory at any rate, it is to the mutual advantage of shareholders and consumers that the price of gas shall be low. The charge prior to the recent increase was 3s. 4d. per 1000 cubic feet, while it is now 3s. 8d.; but the effect of the increase in price has not, in practice, been to reduce the rate of dividend actually paid on the ordinary stock. It is possible for the Company legally to increase the price of gas to 3s. 11d. per 1000 cubic feet without making any reduction in the rate of dividends now paid by them; and it does not appear, therefore, to the Committee that the provision of the Acts in question is, in practice, sufficient to ensure the supply of gas at a reasonable price. Moreover, even if the income of the Company were in excess of the amount required to pay the increased dividends which the present price of gas authorizes, it would not be incumbent on the Company to reduce the price of gas; for their Acts empower them to apply their income to the formation of various funds. So that, unless the Company have the will to reduce the price of gas, they are practically under no obligation to do so. The Company's Acts authorize the Corporation once every year to have the accounts audited for the purpose of ascertaining that the profits are properly applied; but inasmuch as the Company have the wide powers of application of their income mentioned, there is little likelihood of any such audit resulting in effecting a reduction in the price of gas.

Having arrived at these conclusions, the Committee have, as instructed, considered whether the purpose desired could be achieved by the Corporation purchasing the Company's undertaking. When the Company promoted their last Bill in Parliament, in the session of 1914, the question of acquiring the undertaking was considered by the Council; but it was decided that powers should not then be sought. They were, however, professionally advised that there was no apparent reason why gas should not be supplied at a much lower price than that charged by the Company, and that there was every prospect that the undertaking could be acquired and carried on by the Corporation with advantage both to the ratepayers generally and to the consumers. The Committee are regretfully compelled to admit that the present times are not propitious for the Council to embark upon an undertaking of such magnitude; but they are strongly of opinion that, after the termination of the war, the Council would be well advised to consider very carefully whether they should not seek parliamentary powers to acquire the undertaking of the Company—particularly as the Corporation are now the owners of works supplying a part of the borough. The situation of these works is not ideal; and the Committee feel that, with the extension of the borough both east and west, to which the Council may, in their opinion, confidently look forward, the question of whether the existence of both the works of the Company and of the Corporation ought to be perpetuated in their present situations, is one which will be required to be gravely considered at no distant date.

The report was submitted at a meeting of the Town Council which was held last Tuesday.

Mr. NEWITT, in moving its adoption, said it seemed at present impossible to take any proceedings which would bring about a reduction in the price of gas. They found that the powers given to the Corporation in one direction were taken away by counter actions in others. The rise in the price of gas of 4d. per 1000 cubic feet meant £6500 a year excess payment by the consumers. They naturally looked to the Gas Company's balance-sheet to see the reason for this; and they found the only one given was the increase in the price of coal. This was, however, more than met by the better sale of bye-products. Therefore, he thought the decision to appoint a Committee to inquire into this extortion was wise. In 1910, the Council were told the Company was grossly mismanaged and grossly over-capitalized, and that if the concern had been properly managed and controlled the proper price of gas would be 2s. 6d. The Committee had wisely said the moment was not propitious for taking over the works. They were of opinion that such a course would be of advantage to the town; but it involved large financial and other considerations. It was for the Council to consider, when the war was over, if they would purchase the works and improve the amenities of the town.

Mr. HOWARD was surprised the Committee did not pass a vote of censure on the Company for raising the price of gas.

Mr. MITCHELL remarked that the capital of the Company at the present time was £428,090. It was ridiculous to suggest that the undertaking could be purchased for £300,000.

The MAYOR (Mr. Joseph Francis) pointed out that the Council were not discussing now whether they should purchase the works. The Committee only expressed the opinion that at the termination of the war the Council would be well advised to consider the matter.

Mr. MITCHELL retorted that the Council would be ill-advised to purchase the works. The town would lose £150,000 by the purchase. The expert opinion the Council had that they could sell gas at 2s. 6d. per 1000 cubic feet was probably not worth the paper it was written upon. The proposition of purchasing the works should be nipped in the bud, as it might become a distinct menace to the town. He referred to the fact that the Corporation's Leigh gas undertaking had handed over £500 in relief of the rates. This he thought, considering they sold gas at 3s. 4d. as against 3s. 8d. charged in Southend, was very creditable.

The Committee's report was then adopted.

WATFORD NEW WATER SUPPLY.

At the last meeting of the Institution of Municipal and County Engineers, which was held at the District Council Offices, Watford, Mr. DAVID WATERHOUSE, the Engineer and Surveyor to the Council, contributed a paper on the

NEW WATER SUPPLY OF WATFORD.

He said that, with the rapid growth of Watford, the necessity of carefully considering its future water supply became urgent. The old works were of such a nature that they could not be suitably extended. The site was not sufficiently large to be utilized for new works; and, moreover, it was necessary that the supply to the town should be maintained during the construction of any new works. It was possible to draw an abundant supply of water in the neighbourhood along the Colne Valley; and as there was no necessity to go farther afield to find a suitable site for new works, a site adjoining the old water-works was purchased.

In 1903 the author submitted for the consideration of the Council a report on a new water scheme. This proposal embodied a new deep well, pumping-station, and softening works, a service reservoir to hold 2 million gallons, situated at Merryhill, Bushey, and the necessary pumping and delivery mains, which would be connected to the existing distribution system. With this combination a constant supply of water at an increased pressure could be assured to the town, which would meet double the existing demand. After considerable delay and much discussion by the Council, which continued over several years, it became necessary to submit a revised estimate for the scheme, amounting to £114,000. This scheme was based upon a supply of 1,500,000 gallons in ten hours. The scheme was approved; and after due consideration the Council decided to promote a Bill in Parliament, which became law in August, 1909.

It was decided in 1910 to carry out certain preliminary work, which included the sinking of a 30-inch diameter bore-well to a depth of 258 feet, on the site of the new works, for the purpose of testing the yield, and also for use as an immediate auxiliary to the existing supply until the new scheme was completed. A compound undertype engine, with double-acting deep well pump, 28 inches stroke, and 19 inches diameter, with multiple valves, was fixed, and the water pumped through a gauging chamber to waste, or into a closed well at the old water-works. Since the installing of this plant, it has on more than one occasion proved its necessity, by keeping the town supplied when the water in the old wells dropped very low. It also proved there is an abundant supply of water on the site selected for the new works.

In August, 1912, the permanent works were commenced. It was decided to modify the arrangement of a large well, which was the first intention, and substitute five bore-wells, and thus save considerably in the cost. The strata through which the wells are sunk, with the exception of about 25 feet of gravel on the surface, consisted wholly of chalk and flints—the latter intermixed in the chalk or in beds. Four pumping wells, which are under the engine-house, are arranged in two pairs. They were sunk 350 feet deep from the ground level; and for a depth of 80 feet they were lined with tubes 40 inches internal diameter. For the remainder of the depth they were 36 inches diameter and unlined. The boring was carried through by the Contractors without a hitch. From about 30 feet below the surface, it was in water. The boring was carried out with a chisel, with the exception of a short length of hard flint, when a rotary tool and steel shot were used.

The large bored well (No. 5), which was sunk outside the pumping-station, was intended chiefly to provide a working shaft from which to drive headings to augment the supply, should the wells under the engine-house not yield sufficient for the requirements of the town. The headings would be connected-up to the wells under the engine-house, and also to the well under the auxiliary pumping-station, which as before stated, gives such an excellent yield. The No. 5 well is 300 feet in depth, and was bored 84 inches in diameter for a depth of 80 feet, which is lined. The remaining depth is 72 inches diameter. The sinking of this well was perhaps of more interest than the others, on account of its size. It is one of the comparatively few bored wells of its size in the country. The chisel used for the work comprised a mild steel riveted-up frame having thirteen separate chisels and points, ten

of which could be removed for renewal. The chalk slurry was removed from the boring by a grab attached to a steel rope, and operated by the boring winch. The grap discharged into tip-waggons, which were run to a convenient part of the site for tipping.

The pumping-station comprises an engine-house, engine-house basement, fitting shop, boiler-house, chimney shaft, coal-store, superintendent's office, lavatory, and general store. It is built in brickwork on concrete foundations, and faced externally with grey Chesham facing bricks and Darley Dale stone dressings.

A 20-ton travelling crane carried on the main walls is provided in the engine-house, and is worked by hand from the floor by endless chains; the heaviest lift being when it is withdrawing the low-lift pump buckets from the barrels with a superimposed column of water. The engine-house basement and the engine-house are erected upon a concrete raft reinforced with expanded metal. The suction tank for the high-lift pumps is arranged in the basement, and is constructed in reinforced concrete, as are also the walls of the pump well chamber. The chimney shaft is built on the same principle as the Custodis chimneys. It is 121 feet in height, built circular, with an octagonal base, upon a reinforced concrete bed, 18 feet square, and is lined with fire-brick for the first 40 feet. The inside diameter at the top is 6 feet; at the bottom it is 6 ft. 3 in. inside the fire-brick lining. The bricks used in its construction were specially made and perforated to form a key for the mortar.

The main pumping plant, which has been arranged in duplicate, so that there is a complete stand-by to meet every contingency, comprises two triple-expansion horizontal Worthington high-duty surface-condensing pumping-engines, each set being equipped with low-lift (bore-hole) and high-lift pumps. The water is delivered from the bore-wells into the softening plant at the rate of 2500 gallons per minute, from a depth of about 150 feet below the surface, at which level the required quantity is obtained. However, provision has been made that, should it be required, the water can be pumped from a depth of 350 feet below the engine-house floor level. Under this condition, the plant would be steamed at 200 lbs. instead of 160 lbs. per square inch. After the water has passed through the softening plant, it gravitates back into the suction tank in the engine-basement, whence it is taken by the high-lift pumps and delivered into the service reservoir. The total pump horse-power that has been provided for may vary from about 370 to a maximum of about 500.

The boiler plant comprises two Lancashire boilers, 30 feet long by 8 ft. 6 in. in diameter, which are worked at a pressure 200 lbs. per square inch. Each boiler is fitted with Hopkinson's patent mountings, and is equipped with Vicar's coking stokers, which are driven by means of a 3 B.H.P. motor. They are also fitted with Ferguson's sectional superheaters. A Green's improved fuel economizer made of 96 tubes is fixed in the main flue; and a small motor is provided for operating the economizer scrapers. The boiler-flues are equipped with a patent flue-dust extraction plant. The plant comprises dust-collecting tubes laid along the bottom of the flues, having intake ports, and fitted with inside sleeve valves, which are operated by central rods actuated by mechanism outside the boiler. The extraction of the dust is by means of a special ejector connected to the steam-main, and discharging into a tank outside the building. With this plant, the dust can be collected at any time, whether or not the boilers are under steam.

After inspecting various systems of softening water for town supplies, it was finally decided to adopt the "Haines" continuous system, and to reduce the hardness from about 21° to 6° or 7°. The softening works comprise a lime-store, lime slacking room, and filter-house, with the "Haines" softening plant. Beneath the filter-house is constructed a concrete tank for receiving the softened water after filtration, and immediately adjoining the filter-house is the softening tank. The filter-house building is similar in character to the pumping-station. The softening tank is constructed above ground in concrete, reinforced with steel bars and expanded metal. It is covered in; the cover being supported by reinforced concrete piers and the baffle walls. The internal surface, with the exception of the underside of the roof, is rendered in cement and Pudlo. The reagent used to soften the water is lime, in the form of a saturated solution of a standard strength. There are six lime solution cylinders—one always being kept fully charged, to be substituted for the one taken out of work for charging, which operation occupies but a few minutes. Connected to the main pumping-engines, and working in direct ratio to it, is a governor-pump, which delivers 10 per cent. of the total water pumped, to two small tanks over the lime cylinders. On the pump there are means of adjustment, so that the hardness can be reduced or increased as required. From the tanks the correct quantity of water is passed to the cylinders.

From the cylinders, the lime water is conveyed by gravitation to the mixer at the far end of the softening tank. Here the hard water from the low-lift pumps enters into the tank and falls in a thin sheet over the edge of a large bell-mouth. Above the bell-mouth, and concentric with it, is a circular basin, with a turned curved lip of less diameter than the bell-mouth. The lime solution gravitating to the basin flows over the edge in a thin sheet, and is at once intimately mixed with the sheet of hard water flowing over the bell-mouth; and as they together fall into the tank, they are thoroughly mixed, broken up, and aërated. The water thus mixed flows slowly through the softening tank, where ample time is allowed for the chemical reaction to be complete before the water is filtered. The softening process having been completed, a large portion of the carbonate of lime in suspension is deposited in the tank. The remainder is removed by means of the "Haines" patent filters. There are eleven filters, each occupying the space of 8 ft. by 4 ft. by 6 ft., and having an effective filtering area of 540 square feet, capable of filtering some 13,000 gallons per hour continuously. Each filter tank contains a series of rectangular plates, so arranged that both sides are used for filtering, thus giving a large filtering area in a small space. An envelope of special woven cloth is slipped over each plate, and fastened in a simple manner by a grip-ring. The turbid water, on

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being admitted to the filter, percolates through the filtering medium leaving the deposit on the face. On the bottom of each tank is a collecting chamber, furnished with twenty openings or ports, into each of which one of the filter plates fits and forms a joint by its own weight on a washer of the cloth. Thus any single plate can readily be withdrawn and be replaced in a few minutes when required. From the collecting chamber the soft filtered water is delivered quite clear to a tank under the filter-house, and thence flows to the suction tank of the high-lift pumps of the main pumping-engine.

At the commencement of the war, it became necessary to apply to the Treasury for sanction to borrow money to proceed with the scheme; and as it appeared unlikely that they would sanction money for completing it, it was decided to postpone the construction of the reservoir, and also the laying of the major portion of the delivery and pumping mains, until after the war, and in the meantime to connect-up to the present system. The reservoir is therefore part of the scheme yet to be completed. The reservoir will have a capacity of 2 million gallons with its top-water level at 446 feet above Ordnance datum. It will be 200 feet in length by 109 feet in width, with a depth of water of 15 feet, and will be divided into two compartments, by a division wall, 10 feet in height. The walls and reservoir bottom will be in concrete; the roof and roof beams will be in reinforced concrete supported by piers of blue brick. The division wall will also be in reinforced concrete carried by reinforced buttresses. These will be continued up as piers to support the roof in place of a line of brick piers. Internally the walls and floor, and externally the roof, will be waterproofed with ¾-inch of cement rendering; fillets being run to all internal angles. The valves controlling the inlets, outlets, and washouts are all arranged in chambers outside the reservoir, so that none of them will be under water. A recorder-house is arranged at one corner of the reservoir for accommodating the float-gear for an electrical recorder at the pumping-station.

The water will be delivered eventually by high-lift pumps through an 18-inch cast-iron main, 3960 yards in length, to the new reservoir.

The PRESIDENT (Mr. J. S. Brodie, of Blackpool) said it was a mark of wisdom on the part of the Council to take the matter in hand, and make provision for the future; but he considered they would have been justified in making ever more provision than they had done. The provision they had made would not supply more than double the present population.

Mr. H. T. WAKELAM (County Surveyor of Middlesex) said it would have been interesting to have had the cost per 1000 gallons of the water-softening process. They had from time to time information in this direction; but they rarely had the cost given to them, which was one of the chief points in connection with any scheme of the kind.

Mr. J. P. BENNETT (Harrow) remarked that no reference was made in the paper to the consumption per head, and whether this consumption was high or low, and how much of it was waste. Neither was there any statement as to whether there was any regular system for the detection of waste. It seemed to him that local authorities were in the habit of spending big sums of money on water schemes, and very little money in preventing waste. He knew a place where they reduced the waste from 18 gallons per head to 7 gallons by a Deacon meter. This was with a gravitation scheme. With a pumping scheme, like that of Watford, it would be even more profitable.

Mr. E. Y. HARRISON (Guildford) said he thought the Council and the Engineer were to be congratulated upon the very good scheme of water supply which had been prepared. With regard to the reservoir, he should like to know whether they had considered the building of the whole of it in reinforced concrete, instead of just the roof and the piers.

Mr. L. P. MARSHALL (Saffron Walden) asked what was the consumption per head of the population allowed for per 24 hours? He noticed that the sewage discharge was 1,450,000 gallons, or 32·2 gallons per head.

Mr. WATERHOUSE: 35 gallons.

NOTES FROM SCOTLAND.

Increased Wages in Glasgow.—The Gas Committee of the Glasgow Corporation have received applications from various sections of the employees for an increase in their wages; and after hearing a statement by the General Manager (Mr. Alexander Wilson) as to the rates of wages at present paid to all classes of unskilled and skilled workmen employed in the gas-works and workshops, they have agreed that all shiftmen, semi-skilled workmen, and labourers shall receive an additional war bonus of 2s. per week. This is the third increase granted since the commencement of the war, and makes a rise equal to 1½d. per hour, or 6s. per week. The meter inspectors in the department had also made application for the grant of a war bonus; and the Committee have granted the following: All male meter inspectors and male clerks employed in the Gas Department whose salaries are £65 and do not exceed £125 per annum, a war bonus at the rate of 4s. per week; and female meter inspectors, female clerks, and junior male clerks whose salaries are under £65 per annum, a bonus of 2s. per week. The foremen in the department have made application for an increase of 10s. per week on their wages.

Greenock Gas Department.—At the last meeting of the Greenock Corporation, the accounts of the Gas Department for the year ended June 30, and the estimates for the year to June next, were considered. Much satisfaction was expressed at the successful results of the past year, which ended with a net surplus of £5545; and it was unanimously agreed to give the Engineer and Manager (Mr. James Macleod) an increase of salary of £50, as an appreciation of his working of the department. The estimates were adopted; and the price of gas was reduced by 1d. to consumers by slot-meter—the price to ordinary consumers remaining unaltered. The rebates of 10 per cent. on all

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accounts of £100 and over, and 20 per cent. to the Torpedo Factory and the Aluminium Castings Company are also unaltered. The gas sold and accounted for in 1910 was 300 millions; in 1911, 316 millions; in 1912, 360 millions; 1913, 383 millions; in 1914, 404 millions; in 1915, 426 millions; and in 1916, 450 millions. An increase of some 24 millions for the past year over the previous year is shown. The number of gas appliances out on loan for the past year was 12,639; being an increase of 1586 over the previous year. The number of consumers continues to increase, though last year shows the smallest increase for many years back. Since 1909, there has been a total increase of 2599 consumers. The quantity of coal carbonized last year was 41,348 tons; the make per ton being 11,226 cubic feet, and the gas sold and accounted for 10,877 cubic feet per ton—an increase of close on 974 feet over the previous year. The unaccounted-for gas was 3·11 per cent., as against 3·21 per cent. The new plant is now complete; the gasholder, which was the last item of the extension scheme, being in full use. The whole of the gas required is being made in the Woodall-Duckham vertical retorts.

Increased War Bonus at Arbroath.—The Finance Committee of the Arbroath Town Council have agreed to the recommendation of the Gas Committee to raise the war bonus to all gas-works' employees to 4s. per week.

Hamilton and Excess Profit Duty.—It was reported by the Gas Committee at the last meeting of the Hamilton Town Council that a reply had been received from the Inland Revenue authorities with regard to the payment of excess profit duty on the gas undertaking. The authorities had, on the percentage of capital basis, admitted the right of the Corporation to set against the profits of the gas-works the deficiency on the electric lighting undertaking, the water department (so far as trading only was concerned), and the public hall. They, however, excluded the deficiency on several other undertakings. The result of the appeal is that the charge for the years 1915 and 1916 is dropped; the net profits not exceeding the 6 per cent. on the capital in the concerns allowed by the authorities.

Falkirk and a Calorific Standard.—The Falkirk Town Council have, upon the recommendation of the Gas Committee, agreed to apply to the Secretary for Scotland for an Order under the Gas (Standard of Calorific Power) Act, 1916.

Technical Training and Industry.—The importance of youths coming forward in great numbers to take up the industrial work of the nation after the war, was emphasized by Sir George T. Beilby, when presiding at the annual meeting of the Governors of the Glasgow Royal Technical College. He pointed out that the ranks of experienced scientific workers had been sadly depleted. Many men had been cut off in their most promising years. One of the great lessons of the war was that the future industry of the country must depend on men of high technical training; otherwise they could not hope to keep their place in the world's industry. An institution of this kind was the natural channel through which the need for trained men should be supplied. The prospects for the future employment of trained chemists were very bright indeed. At the present moment it was impossible to supply all the trained chemists wanted. The whole country had been in a very unsatisfactory position from the point of view of chemical manufactures. Mr. Chrystal, speaking on the minutes of the Committee on Chemistry and Metallurgy, drew attention to the useful work that had been done for the Government—among other things, in treating tar for toluol.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Oct.* 23.

Pitch continues firm, and in the aggregate a considerable amount of business has been booked over the export season. Makers to-day would be disinclined to accept below 21s. per ton net, in bulk, at works. There is quite a good demand for creosote from various directions, and the price is steady at 3⅜d. to 4d. per gallon net. in bulk. Other products generally are unchanged.

The export price for 25 per cent. sulphate of ammonia remains at £17 12s. 6d. per ton net, into buyers' bags, at makers' works.

Tar Products in the Provinces.

Oct. 23.

The markets for tar products remain about the same. Business in pitch is still difficult owing to the freight and discharge question. Creosote continues to be sold at a low price. Solvent naphtha is in fair demand; and the price of heavy keeps steady.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 16s. to 16s. 6d. per ton; West Coast—Manchester 15s. to 15s. 6d., Liverpool 16s. to 16s. 6d., Clyde 17s. to 18s. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6⅝d. Solvent naphtha, naked, North, 1s. 10d. to 1s. 11d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2d. to 2¼d. Heavy oils, in bulk, North, 3d. to 3¼d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £20 to £30; salts, 70s. to 80s., bags included. Anthracene, "A" quality, 2½d. to 2⅝d. per unit; "B" nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Oct.* 21.

Although export licences have not been issued by any means freely, the tone of the market has hardened a little during the past week, and values have advanced about 2s. 6d. per ton at all ports. The

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closing quotations for early delivery are £17 15s. per ton f.o.b. Hull, £17 17s. 6d. f.o.b. Liverpool, and £18 f.o.b. Leith. There has been rather more inquiry in the forward position, and some business has been done at a premium of 5s. per ton on prompt prices, but the volume has not been large.

Nitrate of Soda.

The market for this article has remained steady throughout the week, and spot quotations are repeated at 17s. 7½d. per cwt. for ordinary quality and 18s. 1½d. for refined.

Sulphate of Ammonia.

From another source it is stated that the market for this article during the past week has been quiet, but the values remain the same. Outside London makes are quoted at £16 15s.; Hull, £17 12s. 6d.; Liverpool, £17 15s.; Leith, £17 17s. 6d.; Middlesbrough, £17 12s. 6d.

Manchester District Tar Prices.

The average price realized for tar—based on the value of the products—for September deliveries in the Manchester district was 21s. per ton.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is quieter; the lack of ready steamers being the chief cause. The effect of this is, of course, most felt in the branches of the industry that depend on shipments mainly. Prices are therefore unequal, and are influenced by the date at which export can be made. In the steam coal trade, best Northumbrians are from 36s. 6d. to 37s. 6d. per ton f.o.b.; second-class steams are about 29s. to 34s.; and steam smalls are easy from 18s. 6d. to 23s. 6d. When ready steamers can be obtained for the ports of the Mediterranean, however, concessions in the price may be made. In the gas coal trade, the demand is fuller; and though the lack of ready boats does influence the trade, gas coal has more of a home demand than other kinds of fuel. Best Durham gas coals are from 32s. 6d. to 35s. per ton f.o.b.; for second-class qualities the current quotation is from 25s. 6d. to 27s.; and "Wear" specials are from 34s. to 36s. Much of the gas coal trade, however, is on "contract" or "schedule" prices. Freights in the open market are firm; much of the tonnage being commandeered by the Government. Gas coal Tyne to Genoa has risen to 78s., while Tyne to London is still about 12s. For coke, Tyne to Boulogne, 40s. has been paid in the last few days. There are contracts in the market for coal for some of the Scandinavian countries; but the quantities are smaller than usual at this season; and, as far as can be learned, the quotations are not likely to be much below the current prices. Coke is steady, though exports are limited a little. Good gas coke is from 33s. 6d. to 35s. per ton, according to the place of shipment.

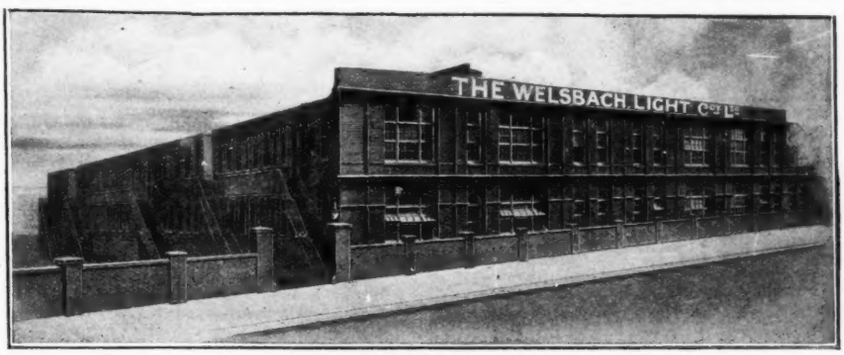
Welsbach Light Company of Australia.—It is stated by "The Times" that the High Court of Australia have upheld the validity of the Trading with the Enemy Act Proclamation, declaring that the Welsbach Light Company of Australia was controlled by, or for, persons of enemy nationality. Mr. Justice Higgins dissented from the decision. The Company, it is added, intend to appeal to the Privy Council.

San Francisco Water Supply.—A water-supply system is being constructed for the City of San Francisco, at an estimated cost of about £9,000,000, and is to be completed during the next eight years. The water will be brought 181 miles from the Hetch Hetchy Valley, and will amount to 400 million gallons per day. The capacity of the aqueduct is not, says "Engineer," as large as that of the Catskill aqueduct in New York, but its length is much greater.

Chemical Industries in the United States.—The United States Bureau of the 1914 census of miscellaneous chemical products manufactured in the country, say that the value of coal-tar products in 1909 (the previous census year) was $4,286,119, and in 1914 $8,839,506. The latter figure does not include the value of 109,901,315 gallons of tar ($2,867,274) produced by bye-product coke-ovens, of 125,938,607 gallons of tar ($3,252 756) produced by gas plants, and of coal-tar dyes and intermediates ($4,652,947) largely from stock of foreign origin.

Birmingham and the Calorific Standard.—The Birmingham City Council, at last week's meeting, agreed to a proposal of the Gas Committee that the Town Clerk should be instructed to make application to the Local Government Board for the substitution of a calorific standard of 500 B.Th.U. for the present illuminating standard. Alderman Sir Hallewell Rogers (the Chairman of the Committee) pointed out that the adherence to ancient standards, which were now of no practical worth, handicapped gas undertakings in getting the quantity of raw materials for explosives which they might otherwise do.

Forthcoming Coal Conference.—Arrangements are being made by the Government for a national conference of the mining industry on the maintenance of the output of coal, to be held at the Central Hall, Westminster, to-morrow. The Home Secretary will preside; and the meeting will be addressed by the Prime Minister, Mr. R. Smillie (the President of the Miners' Federation of Great Britain), Mr. S. Walsh, M.P., Mr. Nimmo (the President of the Mining Association of Great Britain), and Mr. A. F. Pease. The meeting is to be thoroughly representative of the employers and workmen in the coal mining industry, every pit and every trade union lodge sending its representative.



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British Dyes Limited and the Ellesmere Port Works.

At an extraordinary meeting of Levinstein Limited, held to obtain sanction to certain alterations in the Articles of Association which the Board of Trade insisted upon being made before they would consent to the sale to the firm of Messrs. Meister, Lucius, and Bruning's synthetic indigo works at Ellesmere Port, Sir John Lonsdale, Bart., M.P. (who presided), said the Directors considered the acquisition of these works, which were the only works for the manufacture of indigo in this country, would be of the utmost importance to the present and future prosperity of their Company. They were the first firm in the country to approach the Board of Trade intimating their desire to purchase; and as soon as the Receiver or Controller informed them, after careful calculations, of the minimum price that would be accepted, they made them the offer to purchase at this price. However, the process by which the indigo was manufactured was a secret one; and the Government required that the purchasers should give them proof that they possessed the requisite knowledge of this secret process, and that whoever they sold the concern to should satisfy them fully as to their ability to make the indigo as it had been made by the German Company. The firm at once consented to this. In the meantime, two other would-be purchasers approached the Board of Trade and intimated their desire to tender. One of them subsequently withdrew; and it was finally a question as between Levinsteins and British Dyes Limited. The Board of Trade then appointed two Referees, of great scientific knowledge and experience in chemistry, to consider the proof submitted by British Dyes and Levinsteins. In the end their tender was accepted. He observed that at the shareholders' meeting of British Dyes [*ante*, p. 142] the Chairman stated that it was a surprise to the Directors that the Board of Trade had considered that only Levinsteins should be permitted to tender for the works. He was unable to understand this; for, as far as he knew, British Dyes had in every way equal opportunity with themselves, and if they could not satisfy the Referees they surely had no justification either for casting any reflection upon the Board of Trade.

Daylight Saving in France.—The French Professional Gas Syndicat, as the result of an inquiry into the effect of the adoption of "summer" time, have stated that for the month of June the decrease in the consumption of gas was comparatively small—about 3 per cent. for the total consumption in France.

Bingley and a Change of Standard.—A recommendation of the Gas Committee that application be made for an Order substituting a calorific standard for the existing illuminating one has been adopted by the Bingley Urban District Council. In reply to questions by members, it was stated that the alteration, if sanctioned, would not be put into operation without a resolution of the Council, and that notices of a change would be given to all customers, so that any necessary variation of fittings could be made.

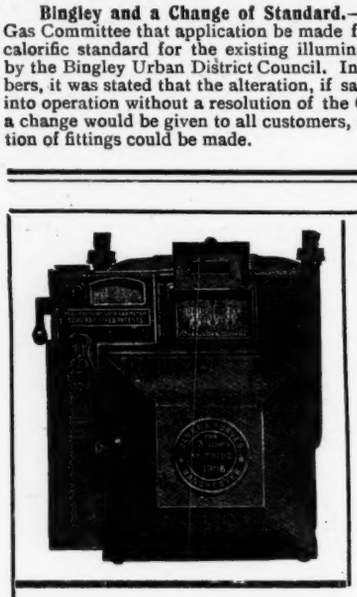
The British Carbonizing Company is among the latest registrations at Somerset House. The capital is £25,000 in £1 shares.

Chelmsford Gas-Works Purchase.—The arbitration which it was announced in the "JOURNAL" would take place in London last week, to determine the price to be paid by the Chelmsford Corporation for the undertaking of the Gas Company, was postponed, in the hope of a price being agreed upon between the parties. Mr. Arthur Valon had been appointed Arbitrator for the Company, and Mr. William Newbigging for the Corporation—Mr. J. H. Balfour Browne, K.C., being chosen to act as Umpire.

Swansea and the Calorific Standard.—Reporting to the Swansea Town Council upon the Gas Company's application to the Board of Trade in the matter of a calorific standard, the Town Clerk said that if they obtained the Order the Company would be gaining a financial advantage. They should be asked to give a calorific power of 550 B.Th.U., instead of the smaller amount proposed. Further, there should be an assurance that, with cheaper costs, after the war, the standard price of gas should be reduced; there should be an undertaking that something would be done as regards the pressure; and flat-flame burners should be supplied to consumers free of charge. These suggestions were adopted by the Council.

Birkenhead Municipal Accounts.—An abstract of the Corporation accounts for the last financial year, issued by the Borough Treasurer of Birkenhead (Mr. T. Sumner), shows that the profit in connection with the gas undertaking was £46,216, as against £25,365 for the previous year—an increase of £20,851, which was accounted for principally by the increased price of gas. The Water Committee reported a profit of £28,926. The new works capital account showed an expenditure during the year of £133,878, increasing the total outlay on the new water scheme to £534,479, exclusive of promotion expenses. The debt unredeemed at the end of the year was £719,926. The Treasury have refused to lend the Corporation any more money to carry on the water scheme, which is practically at a standstill. The Corporation are therefore paying interest on money borrowed for a scheme which is as yet unproductive.

South Australian Gas Company.—The report submitted at the annual meeting of the Company stated that during the twelve months ended June 30 the increase in the output of gas had been satisfactorily maintained. In fact, there were 41 miles of new mains laid, as compared with 30 miles last year. Coke-handling plant was put into operation, and a new holder completed. Expenses increased considerably, mainly owing to the greater cost of imported materials and the higher wages paid. In view of the rapidly growing demand for gas, the Directors are considering the raising of further funds for the erection of additional manufacturing and distributing plant. The accounts showed an income from sales of gas, residuals, &c. (less bad debts), of £204,676; there being a balance to the profit and loss appropriation account of £53,547. Dividends absorbed the sum of £52,233; and £1314 was placed to special reserve.



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Restricted Lighting.—As an instance of the effect of this order on gas companies, it is stated that the Walthamstow public lighting account for the present quarter stands at only 14s. 11d., as against some £500 at ordinary times.

Increase in Price at Lichfield.—The Directors of the Lichfield Gas Company announce that, owing to the advance in wages and the increased cost of coal and all other materials, they are compelled to raise the price of gas, as from the beginning of next year, from 3s. 8d. to 3s. 10d. per 1000 cubic feet.

Strabane Gas Managership.—Mr. H. B. Gripton, Gas Manager at Strabane (co. Tyrone), has joined the Royal Engineers as Chemist; and Mr. John Gallagher has been appointed temporary Manager. The Gas Committee have decided to keep the position open for Mr. Gripton until after the war, and meantime to pay him £20 a year as Consulting Engineer.

Suicide of a Gas Manager.—At an inquest at Rothwell (Yorks.) on the body of Mr. Oscar Parker, aged 36, the Manager of the local Gas Company, who was found hanging last Thursday in his office, the Jury returned a verdict to the effect that he committed suicide during temporary insanity through worry over an impending change in the managership of the Company.

Drogheda Gas Undertaking.—During a discussion in the Drogheda Corporation on the balance-sheet submitted by Mr. H. W. Saville (Gas Manager), it was stated that the original sum borrowed on account of the acquisition of the gas undertaking and improvements since made was £30,217; and that there still remained due £21,581. Mr. Skeffington argued that, as the balance-sheet disclosed a healthy financial position, it was a hardship on consumers to have the prices of gas and coke raised; but Mr. Saville disagreed on this point. As regards gas consumers' deposits, it was decided that interest at 4 per cent. be paid as from the taking over of the works by the Corporation. Mr. O'Connor paid a high tribute to Mr. Saville's management.

War Bonus at Halifax.—The workers in the Gas Department are included among Halifax Corporation employees of certain departments who, according to a recommendation of the General Purposes Committee, are to be granted a war bonus of 4s. per week to the end of the war and for six months beyond, except that employees in receipt of war bonus under any previous decision of the Council shall not receive a total bonus in excess of 4s., and females and single males under 21 years of age shall receive only 2s. per week. It is provided that, in cases where the standard rate of wages might be increased after the date of this bonus, the bonus shall be proportionately reduced; the bonus not being applicable to employees receiving more than £3 per week wages.

The Gas Committee of the Southend Town Council report that the balance of profits available from their Leigh-on-Sea Gas-Works for the past year amounts, approximately, to £900. It has been resolved that £500 be allocated for the relief of the rates.

A verdict of "Suicide during temporary insanity" was returned at Elland, last week, at an inquiry into the death of Samuel Wilson, a retired moulder's labourer, aged 69, who was found dead in bed, with his face under the coverings, and a rubber tube conveying gas from the pipe.

Acting on the recommendation of the Gas Committee, the Mansfield Town Council have resolved to apply to the Local Government Board for sanction to borrow £1000 for the purchase of gas-stoves, repayable in ten years, and also to ask the Treasury to allow them to raise £3144 for the same purpose.

At their meeting last Thursday, the Lambeth Borough Council instructed the Town Clerk to communicate with the appropriate authority to the effect that the Council understand that in certain areas outside the Metropolitan district the street-lamps are extinguished during air-raids. The Council are of opinion that a similar procedure should be adopted in Lambeth.

The excellent show-rooms of the Burton-upon-Trent Corporation Gas Department are having further attractions added to them in the form of a series of lectures on jam, cake, pudding, and sauce making, and the preparation of supper dishes, and a home bread-making competition, in connection with which a number of prizes will be awarded. Competitors must bake all bread in a gas cooking-stove, and must be gas consumers within the Corporation's area of supply. One 2-lb. home made loaf is to be submitted by each competitor; and after the judging, all the bread will be given to the Red Cross Hospitals. Mr. R. S. Ramsden (the Gas Manager) informs us that the British Commercial Gas Association have helped very considerably by suggesting ideas and details in connection with both these matters.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

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STOCK MARKET REPORT.

On the Stock Exchange last week, markets in general could for a while discover hardly anything calculated to impart a ray of cheerfulness from any point of view whatever. Business was terribly quiet—conspicuously absent—and for much the same causes as those that had made the previous week a very dull time indeed. Chief among these was the formidable competition of the 6 per cent. Exchequer Bonds, which are going off like the proverbial hot cakes, and the French loan, which, as a good second, is much fancied by the public. *En passant* it may be noted that the issue of the 5 per cent. Exchequer Bonds is now closed. Nobody wants them, of course, now that he can have the 6 per cents.

The prevailing depression lasted up to Thursday, when things brightened up and became more active on the receipt of better Roumanian news; and they closed firmer on Friday. The gilt-edged division had meanwhile been a great sufferer (except the War Loan, which remained steady), and Consols on Wednesday touched 56—said to be the record for a century. Home Rail priors were weakened; and the labour hitch at Paddington was unwelcome. Americans were fair; but Canadians drooped at adverse crop statistics.

In the Foreign Market, Japanese was moderately good; but South Americans were out of favour. Argentines were under a cloud, and South African moved irregularly. The Miscellaneous Market was very slack; the public seemingly being disposed to think a bit more before nibbling at the war-profit bait. Rubber and Oils were pretty firm at the close. Business in the Gas Market was most meagre and uninteresting. Only four undertakings were dealt in at all; and of these fully one-half of them had but a single transaction apiece. The prices did not exhibit much change, but on the whole they were not inclined to harden. Nor, indeed, could such a course be expected considering the depressed condition of the leading departments in general. The Money Market was firm upon a strong demand.

Another case of German-owned securities being sold for German banks by German-born members of the Stock Exchange has come to light; and the situation is becoming acute. The Chancellor of the Exchequer, the Home Secretary, and the President of the Board of Trade are to be interrogated thereon in the House of Commons this week.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 77, 77⅜, 77¾, ditto maximum 60, ditto preference 71, Metropolitan of Melbourne 91½. On Tuesday, Commercial 4 per cent. 73, ditto debenture 55, Gas Light ordinary 77, 77½, 77⅝, 77¾, ditto debenture 59¾, 60, Primitiva 43s. 9d., South Metropolitan 83¾, 84¼, 84½. On Wednesday, Gas Light ordinary 77½, 77⅝, Imperial Continental 88, Primitiva, 41s. 2d., 43s. 9d., 44s. 9d., South Suburban 81, Tottenham "B" 90¼. On Thursday, Commercial 4 per cent. 74, Gas Light ordinary 77, 77½, 77½, 77¾, ditto maximum 58, ditto preference 70½, 70¾, ditto debeture 60, Primitiva 43s. 9d., 44s. 6d., South Metropolitan 83½. On Friday, Gas Light ordinary 77⅝, ditto maximum 58½, ditto preference 70¼, 70½, Primitiva 43s. 6d., 45s.

The Bank rate is 6 per cent.—as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When last Dividend.	Previous Div. or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	65—70	..
1,651,868	,,	April 8	2½	5⅛%	Alliance & Dublin Ord.	59—64	62—64	..
874,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	60—65	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6⅜	5—5½	..
60,000	10	Feb. 26	16	16/-	Bournemouth Gas and Water { 10 p.c.	29—30	25—27	..
383,110	10		7	7/-	B 7 p.c.	15—15½	11—11½	..
115,000	10	,,	6	6/-	Pref. 5 p.c.	13½—14	9½—10	..
159,740	—	—	—	4%	4 p.c. Deb.	..	73—75	..
992,045	Stk.	Feb. 26	†14	55/-	Brentford A Consold.	261—266	86—88	..
734,920	,,	,,	†11	53/9	Do. B New	204—209	83—85	..
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	85—90	..
221,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—98	..	..
317,330	Stk.	Feb. 26	11	10⅜%	Brighton & Hove Orig.	208—218	1°5—168	..
244,200	,,	,,	8	7⅝%	Do. A Ord. Stk.	154—159	121—124	..
580,000	20	Mar. 26	12½	22/6	British	44—45	34—35	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	71—73	..
245,771	Stk.	June 26	4	4%	Buenos Ayres 4 p.c. Deb.	85—87	60—65	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	1½—1⅝	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	4⅓—5	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	Stk.	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	85—86	..
1,513,280	Stk.	Feb. 12	5 9/4	49/8	Commercial 4 p.c. Stk.	106—108	72—74	73—74
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	68—70	..
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	55—57	55
800 000	Stk	,,	4	—	Continental Union, Ltd.	76—79	36—38	..
200 000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	55—57	..
278,400	—	—	—	11¼%	Croydon B and C 7 p.c.	..	175—185	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.		6	5⅞%	Derby Con. Stk.	128—135	100—105	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	7/6	European, Ltd.	17½—18	12½—13½	..
16,313,430	Stk.	Feb. 10	4/17/4	42/-	Gas { 4 p.c. Ord.	9½—102	77 78	77—77½
2,600,000	,,	,,	3½	3½%	Light { 4½ p.c. max.	76—79	58—60	5·—60
4,062,285	,,	,,	4	4%	and { 4 p.c. Con. Pref.	96—99	70—72	70½—71
4,674,850	,,	June 11	8	8%	Coke { 3 p.c. Con. Deb.	72½—74½	59—61	59½—60
130,000	,,	,,	10	10%	10 p.c. Bonds	..	..	..
358,740	Stk.	Mar. 12	5	4½%	Hastings & St. L. 3½ p.c.	87—89	78—83	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16⅝	8—9	..
86,600	—	—	—	9⅛%	Hornsey 7 p.c.	..	125—135	..
131,000	Stk.	Mar. 12	7½	7⅜%	Ilford A and C	151—154	112—117	..
65,780	,,	,,	6½	6⅜%	Do. B	115—119	103—108	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	73—76	..
4,940,000	Stk	May 14	9	4½%	Imperial Continental	150—160	88 93	88
1,235,000	Stk	Feb. 12	3½	3⅛%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,242	Stk	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	87—92	..
2,498,905	Stk.	Feb. 26	10	£%	Liverpool 5 p.c. Ord. { A	211—213	87—88	} ..
					{ B	146—148		
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	78½—79½	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4¼—4⅝	4—4½	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	89—93	91½
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8⅞—9½	..
1,875,892	Stk.	July 29	4½	4½%	Newc'tle&G'tesh'd Con.	98⅝—99½	80—81	..
529,705	Stk.	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	75—77	..
55,940	10	Feb. 26	7/14/0	7/8⅝	North Middlesex 7 p.c.	14—15	10½—11½	..
800.000	Stk.	May 14	8	£%	Oriental, Ltd.	117—122	108—110	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅞	2—3	..
60,000	50	Feb. 26	13	12%	Porto.a, Island B	128—131	92—97	..
100,000	50	,,	12	11%	Do. C	118—121	92—97	..
52,000	50	,,	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	2 1/16—2 3/16	41/3—45/-
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅞—5	3½—4	..
621,600	100	June 2	4	4%	,, 4 p.c. Deb.	91—98	80—82	..
—	—	—	—	4%	,, ,, 1911	..	..	..
846,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	60—65	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	8—8½	..
125,000	50	July 1	5	£%	{ 5 p.c. Deb.	47—49	43—45	..
135,000	Stk	Mar. 12	10	10%	Sheffield A	228—234	188—192	..
209,984	,,	,,	10	10%	Do. B	228—234	188—192	..
523,500	,,	,,	10	10%	Do. C	220—222	188—192	..
90,000	1	May 28	9	6/-	South African	10½—11½	..	..
6,609,895	Stk	Feb. 10	5/4 0	44/-	South Met., 4 p.c. Ord.	111—118	83—85	83¾—84½
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	59—61	..
224,830	Stk.	Feb. 26	8½	8%	South Shields Con. Stk	157—159	148—150	..
952,795	Stk.	Feb. 26	8	4⅜%	S'th Suburb'n Ord. 5 p.c.	114—116	80—82	81
60.000	.	,,	5	5%	Do. 5 p.c. Pref.	110—119	79—81	..
135,000	—	—	—	4⅜%	Do. West Kent.	..	..	..
187 558	,,	June 26	5	5%	Do. 6 p.c. Deb. Stk.	116—118	90—92	..
647,740	Stk	May 14	5	£%	Southampton Ord.	99—103	90—95	..
120,000	Stk.	Feb 12	7½	7½%	Tottenham { A 5 p.c.	125—128	120—123	..
782.276	,,	,,	6	5⅝%	{ B 3½ p.c.	116—117	90—92	90½
181.256	,,	June 26	4	4%	District { 4 p.c. Deb.	87—89	73—75	..
189.390	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149.900	10	July 1	5	£%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
296.476	8 k	Mar. 12	5	£%	Tynemouth, 5 p.c. max.	103½—109½	91—92	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	117—122	..
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	101—103	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	88—93	..
352,000	,,	,,	6¾	67/6	Wimbledon 5 p.c.	117—122	93—98	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c.	121—126	98—103	..
98.416	,,	June 26	3	3%	3 p.c. Deb. Stk.	66—69	53—56	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Secretary. Brentwood Gas Company.

Supervising Engineers (Chemical Works). No. 6232.

Carbonizing Superintendent. No. 6234.

Assistant Works Foreman. Northampton Gaslight Company.

Carbonizing Foreman. Chesterfield Gas and Water Board.

Store-keeper. No. 6233.

Gas Fitter. Haverhill Gas Department.

Gas and Water Fitter. Whitstable Gas Company.

Stokers. No. 6231.

Appointments Wanted.

Managerial or Secretarial Position, &c. No. 6229.

Meeting.

Ceara Gas Company. No. 9, Queen Street Place, E.C. Oct. 27, one o'clock.

Patent Licence.

Incandescent Mantles. Haseltine, Lake, and Co., 28, Southampton Buildings, W.C.

Plant, &c. (Second-Hand) For Sale.

Boiler Tank, Steam Waggons, Traction, &c. Stanley Engineering Company, Bath.

Gasholders and Governors. No. 6228.

Wanted to Purchase.

Carbon. No. 6192.

Wanted to Hire.

Road Tank. A4, care of Messrs. W. H. Smith and Son, Manchester.

TENDERS FOR

Fire-Clay Goods.

Sheffield Gaslight Company. Tenders by Nov. 3.

Lighting Goods, &c.

Calcutta Corporation. Tenders by Feb. 19.

Tar.

Reigate Gas Company.